



FRIDAY, APRIL 18, 1902.

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Contributions

The English Units and the Metric System.

New York, March 28.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Mr. Charles T. Porter in a letter in to-day's issue on the metric system states that it bids defiance to the principle of using the largest practicable unit for mechanical measurements. This is not true. Mr. Porter forgets the centimeter which is used in place of our inch and the decimeter which is used for the foot. Instead of saying 1,434 mm. a man used to the metric system would say 1.434 m. (meters). Instead of 254 m.m. it is just as easy to say 25.4 dm.

To one accustomed to the metric system the word "decimeter" means as much as the word "foot" does to us now. It conveys an exact idea of length. Of course it would take some time to introduce it. But in Germany after 15 years of teaching in schools, etc., it had practically supplanted the old system. True, there are still in use some of the ancient words denoting measurements of length, square and cubic measurements, just as there are still in use some of the old names for coins. But their meaning has been adapted to the new system, so that they no longer convey to the mind of the people the valuation which attached to them under the old system.

There is no doubt that for some purposes the division into halves or bisection is desirable. We have used it in our decimal system of coinage by introducing the half and the quarter dollar. There is, therefore, apparently no reason why the same limited usage of bisection could not be employed in the metric system for other measurements. By all means say the "half" meter, or "quarter" meter if you want to. But by all means use as a basis a system which permits of rapid and accurate computation.

E. D. T.

Lexington, Ky., April 10th, 1902.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Your issue of March 28th contains an article on the Metric System, in which some very good objections are raised, taken from the standpoint of a mechanical engineer. While for a civil engineer the decimal system is a great advantage, still there are a few points it would be well to consider before such a radical change is made. The following table gives the relation of the meter to our present system:

| |
|---|
| 1 m = 3.281 ft. = 39.37 in. = 39 3/8 in. |
| 1 dm = .3281 ft. = 3.937 in. = 3 9/16 in. |
| 1 cm = .03281 ft. = .3937 in. = 3/8 in. |
| 1 mm = .003281 ft. = .03937 in. = 5/128 in. |

In running ground levels or cross-sectioning we read to tenths of a foot, but must take to hundredths of a meter. Levels on masonry we give to hundredths of a foot, while with the meter we must give to thousandths, which would only be necessary in very fine work. The foot would give more refinement with the same number of places.

For the general run of field engineering the 100 ft. tape is considered long enough. The 30 meter tape corresponds

to the 100 ft. tape, but there one loses the advantage of the decimal system, and must either put 30, 60, 90, 120, till a plus is reached, which must be added at once, with the liability of error increased. If one puts station 1, 2, 3, 4, etc., and his plusses added as we do with the 100 ft. stations, then you must multiply by 30 and add your plus to get your distance.

The metric system in drafting has an advantage over ours in the fact that it is simply a reduction in a certain proportion, while we bring in a different unit, the inch. This could be obviated by using a scale of foot and tenths and the proportionate scales.

The above facts were brought home to me by a 15 months' use of the metric system. If the change is made, I hope it will not be like the meter itself, which, fashioned by an arbitrary rule was found to be wrong.

C. C. FITZ GERALD.

Electricity for Main Line Working.

New York, March 10, 1902.

TO THE EDITOR OF THE RAILROAD GAZETTE.

I was much interested in the article in Sunday's *Sun* on "Electricity for the Central," evidently contributed by one of the electrical engineers of the General Electric Company.

The statement is one of those "glittering generalities," many of which have already been refuted; but I would call attention to one misstatement which may be taken as a basis for the inaccuracy of the entire article.

The writer of the article states that the Atlantic type of engine now hauling the Empire State Express, the Lake Shore Limited, etc., burn twelve to fifteen pounds of coal per horse-power developed per hour. The fact is that the engines hauling the Empire State Express do not consume more than five pounds of coal per horse-power per hour. Passenger engines have been built and are being built which will develop 2,500 h. p., in place of the 1,400 h. p. this writer speaks of as the power of the Baltimore & Ohio electrical locomotive used in the tunnel at Baltimore, and do it with a maximum consumption of two pounds of coal per horse-power per hour.

The writer of the article speaks again of the development of the electrical locomotive as having been accomplished within the past five years. Everybody knows that about twenty years have been consumed in the development of the electric motor and locomotives, and for the past fifteen years the same statements have been made that he makes in regard to heavy train service with electrical power. In 1886 a friend of mine visited Henry Villard, who was then President of the Northern Pacific and also President of what was then known as the Edison General Electric Company. The purpose of his visit was the discussion of an improved steam locomotive. Mr. Villard received the gentleman very cordially, but told him it was not worth while discussing the subject as the entire Northern Pacific Railroad would be equipped within three years with electrical power and there would be no use for steam locomotives.

There is not a Trunk Line or a railroad of any size in the United States that could stand the additional expense of changing their equipment and motive power from steam to electricity. If it were tried it would soon be demonstrated that the interest on the additional outlay would be more than the entire fuel bill for operating the road by steam to-day.

I would like to have the gentleman who wrote the aforesaid article please explain why it is that a steam locomotive consumes from twelve to fifteen pounds of coal per horse-power per hour, and how a horse-power is obtained in a stationary plant by a steam engine for one pound of coal.

GEO. S. STRONG.

Per Diem Arguments.

The principal points that will come up for discussion, in the consideration of the Car Service committee's report at the meeting of the American Railway Association, are succinctly summarized in the statements sent to the committee by two prominent roads; and these statements we are permitted to quote below. That of the Baltimore & Ohio was probably made by Mr. Arthur Hale, Assistant General Manager of that road, formerly at the head of the Car Accounting Department of the Pennsylvania, and one of the best posted men in the country on the problem under discussion. Mr. Hale is now chairman of the Car-service committee. The Chicago & North Western maintains that to make the change from the mileage basis to the per diem will be found very difficult, if not impossible, because of the impossibility of making a satisfactory readjustment of switching charges in large yards. Its officers have published arguments against the change.

BALTIMORE & OHIO.

Difficulties.—The difficulties which we shall meet in trying per diem in the future will largely be the same as we encountered when we tried it in 1888. They may be summarized as follows: 1. The accounting difficulties. 2. The question as to the per diem on wrecked cars. 3. The question between railroads as to the date of interchange of certain cars. 4. General relations of per diem with embargoes on freight. 5. The fact that railroads may desire to unduly hold cars of other railroads at the regular per diem rate. 6. The indisposition of certain railroads, especially belt lines, and those with a large amount of terminal work, to go into the scheme at all; together with the probability of their dropping out in case the arrangement did not prove immediately lucrative.

Remedy.—To obviate these difficulties I would suggest:

Difficulties one to four are fully covered by the rules submitted by the Car-service committee of the American Railway Association in 1898. We would suggest that these rules be taken as a basis for the new scheme, with the following exceptions: In case a railroad receiving cars after midnight is able to deliver the same cars before the following midnight, this railroad should not be called upon to pay any car service. This in order to make the incentive for prompt movement as great as possible, and to avoid an increase in the car days beyond 365 in the calendar year. Next, the per diem charge on cars shifted for the purpose of receiving or discharging freight should be paid by the railroad by which the shifting is done, and not by the railroad for which the shifting is done. This in order to provide an incentive on the part of the railroad actually handling the cars to handle them promptly. The fifth difficulty can probably best be overcome by providing simply for a normal rate per diem, which shall be charged between railroads where no other terms are stated, thus reserving the right to car owners to vary the per diem up or down, according to the demand for cars. The sixth and chief difficulty should be prevented by negotiations with railroads likely to object to the scheme. The enforcement of an adequate demurrage charge against consignees should enable any terminal railroad to pay a moderate per diem charge. This would cover practically all cases, excepting where freight is held for transshipment, and here, if it is found that the per diem does not enforce adequate unloading and storage facilities, the division of the freight rate might be so arranged as to give the railroads affected a sufficient additional proportion to cover their per diem. In case any such compromise is made, pains should be taken to preserve payment of the per diem and with it the incentive for promptly moving all the cars. The difficulty experienced in 1888, by railroads dropping out of the scheme on short notice, could be provided for by an agreement that the scheme should be kept in effect long enough to admit of a thorough trial; that is, at least a year.

CHICAGO & NORTH WESTERN.

Difficulties.—License rental emphasizes the rights or privileges of foreign roads, reduces the owner's certainty as well as chances of relief. (b) Demand for relief by lines who provide switch terminals for connections. This concession would provide a way by which those so inclined might make errors similar to what is said to exist with mileage plan. (c) Inequality of the same per diem charge as between different types of cars. (d) Placing responsibility upon receiving line for the excess ability of shippers as well as disability of consignees. (e) In ordinary seasons, during the close of navigation, this company holds from 1,500 to 4,000 cars of grain on its tracks at Chicago, from 15 to 45 days, waiting upon Eastern lines to relieve elevators through which this grain must pass. Many of these cars are foreign, returning home under load. Who shall pay per diem on both foreign and domestic cars? (f) Large increase in office expense. Nearly all mileage statistics now compiled are a necessity. Per diem will require an additional department and large expenditures.

Remedy.—There is a difference between theorizing and actually securing results, and we are unable to suggest anything logical which is also practical. Any plan which removes the obstacles to per diem is of equal advantage in its application to mileage.

The committee asks the question, "Would the adoption of the straight per diem method result in an accelerated movement?" My answer is that it would not. Increased individual car mileage or accelerated movement? Do not confound one with the other; many cars "move" at terminals without paying mileage, neither will they justify per diem. That which is desired is not dependent upon per diem, mileage or any other form of bookkeeping, but—(1.) Upon railway companies providing sufficient locomotives, cars and terminals to handle their business properly. (2.) That the public shall equip themselves with facilities that are equally liberal and modern. (3.) Universal car service regulations which shall embrace railway free warehouse storage as well as car detention. (4.) Capable and conscientious management.

The Metric System Congressional Hearings.

The official report of the hearings held by the Committee on Coinage, Weights and Measures of the House of Representatives, to consider the bill providing for the adoption of the metric system of weights and measures, has been issued from the Government Printing Office in a 6 x 9 pamphlet of 240 pages, including appendices, an abstract of testimony and a topical index. These hearings began on February 6 and were continued at intervals of a few days until March 6.

The bill under consideration provides "That on and after Jan. 1, 1904, all the Departments of the Government of the United States, in the transaction of all business requiring the use of weight and measurement, except in completing the survey of public lands, shall employ and use only the weights and measures of the metric system; and on and after Jan. 1, 1907, the weights and measures of the metric system shall be the legal standard weights and measures of and in the United States." The bill does not involve the compulsory adoption of the metric system by the public, but is intended to encourage its use.

A large number of manufacturers, engineers, technical and scientific men were invited to appear before the Com-

mittee, and about 30 individuals responded to the invitation, representing, however, a much larger number of important companies and large corporations, and in addition a considerable number of resolutions from various scientific and business organizations were presented. Of those who testified before the Committee only four were opposed to the change to the metric system, two of them representing large manufacturers, the other two representing the bureaus of Steam Engineering and Construction and Repair, Navy Department. Among those favoring the adoption of the metric system were: Mr. James Christie, of the American Bridge Co.; Brig. Gen. William Crozier, Chief of Ordnance, U. S. A.; Dr. A. E. Kennelly, Electrical Engineer; Gen. M. I. Ludington, Quartermaster General, U. S. A.; Prof. Simon Newcomb, U. S. N.; Mr. Jesse Pawling, Jr., representing the special committee of the Franklin Institute; Mr. S. W. Stratton, Director of the National Bureau of Standards; Mr. James K. Taylor, Supervising Architect of the Treasury; Mr. William Whitman, President of the Arlington Woolen Mills, and also representing the New England Cotton Manufacturers' Association; Prof. Elihu Thomson, of the General Electric Co., and Dr. O. H. Tittmann, Supt. of the U. S. Coast and Geodetic Survey. Those opposing the change were: Mr. George M. Bond, of the Pratt & Whitney Co.; Mr. J. H. Linnard, Naval Constructor U. S. Navy; Mr. W. M. McFarland, Acting Vice-President of the Westinghouse Electric & Manufacturing Co., and Rear Admiral George W. Melville, U. S. N., Chief of the Bureau of Steam Engineering, Navy Department. The societies and organizations favoring the change to the metric system included the Massachusetts State Board of Trade; the National Association of Builders; the Engineers' Club of Philadelphia; the Franklin Institute; the American Institute of Electrical Engineers; the National Association of Manufacturers, the National Board of Trade of the United States, and many others.

The principal statements made against the adoption of the metric system were: That it is not adapted to the use of workmen generally in shops and of the people of the country at large; that the transition period between the present system and the immediate compulsory adoption of the metric system would be extremely expensive, inconvenient and annoying, and would take several years; that while a universal system is desirable, the inch is a convenient unit and that work can be done with sufficient accuracy and convenience with the present system; that the compulsory adoption of the metric system would work great hardship and involve enormous expense in the change of drawings and machinery and the maintenance for a time of two systems. Mr. McFarland said that the experts of his company estimated that the cost of the change in the shop alone would be from \$300,000 to \$500,000, while the cost of the necessary changes in drawings would be \$250,000 more, although some of the changes might be made gradually. Mr. McFarland admitted, as all did who testified, that a universal system would be desirable and that there is no possibility of the universal adoption of the English system. He also stated that his company had done work in the metric system.

Prof. Thomson, of the General Electric Company, on the contrary, strongly advocated the change and read extracts from letters from 18 heads of departments and experts in his company approving of the adoption of the metric system, stating that the new system would be of great value in calculation and designing, and that it would facilitate measurements. He said that concerted action on the part of manufacturers would be of great value; that uniformity throughout the world is desirable; that computations and drafting would be greatly simplified, and errors reduced, and that small tools need not be changed and that drawings could be changed gradually as new designs were made; and that economy would result from the change and the advantages would more than offset the inconvenience. The principal arguments of others who favored the change were: The desirability of a universal system; the simplicity and flexibility of the metric system and the facility and convenience in computations; that it can be learned in one-tenth the time, thus reducing the time used in learning arithmetic; while dual standards would be necessary for a time, the advantages of the metric system far outweigh the disadvantages, and that it will be worth all the cost and inconvenience of the transition period; that it will never be any easier to adopt it than now, and the longer the change is delayed the more it will cost; that the growth of our foreign trade requires the adoption of an international system; that gages and tools could be retained until gradually superseded; that goods are already furnished to some Departments of the Government, and made for export, under the metric system without extra cost; that it is universally favored by electrical engineers and generally by architects and builders; that the confusion of the present system is great; among instrument makers the metric system is already in general use, even in their machine shops; that the U. S. Government is now using both systems, and that the expense of the change has been greatly exaggerated.

Most of those favoring the metric system agreed that some time should be allowed before it is adopted in order to give time to prepare for the change. The special committee of the Franklin Institute, which "approves of any movement which will promote the universal introduction of the metric system with the least confusion and expense," consisted of James Christie, A. E. Kennelly, F. E. Ives, Wilfred Lewis, S. M. Vauclain, Jesse Pawling,

Jr., George F. Stradling, H. F. Keller, A. Falkenau and L. F. Rondinella.

As previously noted in the *Railroad Gazette*, a favorable report on the bill to the House of Representatives was ordered at the close of the hearings.

The Brooklyn Bridge Railroads.

BY JULIUS MEYER, C.E.

1. *The Bridge Railway.*—There does not seem to be any longer a divergence of opinion among those who have studied the Greater New York inter-borough traffic problem, as to whether the Manhattan ends of the Brooklyn, Williamsburg and Navy Yard Bridges should be brought into rail connection with each other. It is the only means by which the full carrying capacity of the bridges can be developed. Having upon the completion of the Navy Yard bridge invested an aggregate of about \$36,000,000 in the three bridges, the city, it is to be hoped, will not hesitate to invest another say 10 per cent. of that sum in a junction line in order to reap the full benefit of the original investment. The divergence of opinion, such as there is, is at this time rather upon the route that the junction line is to follow, and the object of present discussion is not so much to further immediate construction as to find a plan suitable for use as a basis for necessary legislation.

The ideal route, others have stated, would be a north and south railway along the line of the greatest density of population, Broadway, in conjunction with an east and west line from river to river, which would intercept and connect with all the other north and south transit lines on Manhattan Island. That being out of the question the route should be brought as near as can be to the ideal one, and should make at least all the north and south transit lines east of Broadway its feeders.

But the route must do more than furnish simply the best paying connection; it must offer facilities to receive and deliver passengers at points where there will be no chance for congestion, and it must relieve the congestion at the Manhattan terminal of the Brooklyn bridge and at the City Hall station of the Manhattan Elevated Railroad. The route should also result in a line which will admit of the operation over Brooklyn Bridge of electric trains at 30 seconds time interval; give ample time for station stops; have at each station trains in both directions; every train to reach every feeder; local trains to return to their bridge in the same rotation in which they leave it, and to be so timed that they do not overlap at the bridge terminal and bunching of trains is avoided. It should further be possible to operate the three bridges, their junction line and connecting lines as one system, and also to operate the Brooklyn Bridge railroad as an independent unit without thereby interrupting the simultaneous joint operation of the other two. Finally, the four-track Brooklyn Bridge railway should be separated without a grade crossing into the two double track lines leading to the other two bridges.

Accordingly my route is laid as follows: Fig. 1. From the Manhattan terminal of Brooklyn Bridge northward into North William street to Park Row; thence through the blocks to corner Baxter and Worth streets. To this point the line is four-track; thence one double track line in Baxter, Canal, Centre, Grand, Essex and Delancey streets to Williamsburg Bridge, and another double track line in Worth street, Chatham Square, Bowery and the Navy Yard Bridge plaza to that bridge; also from the Bowery through Christie street to Grand street. Stations are located at Franklin street in Baxter, at Howard street in Centre, at the Bowery in Grand street, and in Chatham square; furthermore at Allen street in Grand street.

On the bridge the four tracks of the Brooklyn Bridge Railroad are gauged into the space of two; they are drawn apart in the terminal. Turning northward they will be gauged as far as Park Row and there will be drawn apart again. The track rises from elevation

+ 68.165 at the terminal to + 74.5365 over the Manhattan Elevated Railroad at North William street and Park Row in about 250 ft., a 2 per cent. grade. At Franklin and Baxter streets the grade of the street is + 14.5, hence base of rail + 32.5, a down grade of 42 ft. in 1,400 ft.; a 3 per cent. grade. Advantage is taken of this grade to separate the Baxter and Worth streets lines without a grade crossing; the tracks to Baxter street drop 3 per cent., those to Worth street 1½ per cent., and where the lines separate, the inner tracks cross overhead. The Centre street station is at elevation + 29, the other three stations are above the Manhattan Elevated Railroad. Radii are from 230 ft. to 250 ft.

It will be noticed that as long as the Williamsburg and Navy Yard bridges are not connected in, there is not a switch in the entire line from and to the Brooklyn end of the Brooklyn Bridge, and there will be only two operated against the point after those connections have been made. Trains run at 30 seconds headway on the bridge and turn alternately into Baxter and Worth streets, running at 60 seconds headway on the loop. Length of line and grades being practically identical in both directions, what slight difference there will be in the running time of the trains on the loop can be equalized in the stop at the bridge terminal so that trains can to a certainty leave for the bridge every 30 seconds. When operation on the other two bridges begins, there will be one train leaving the loop towards those bridges for every train reaching the loop from them, so that trains on the



Fig. 1.—An Elevated Railroad Connection for the Brooklyn Bridges—Manhattan End.

loop will never be closer than at 60 seconds time interval on each track. Connection with the subway is effected at the Centre street station of the loop with the Canal street subway station in preference to making this connection at the bridge. Base of rail at Centre street is + 29; at Canal street in the subway — 6, a vertical distance of 35 ft. and chance to put in elevators. At the City Hall subway station base of rail is + 11.5; vertical distance from bridge rail 56.665 ft. and no chance to put in elevators.

Relief of the crowding at the City Hall station of the Manhattan Elevated Railroad is expected through the operation of the junction line for the following reasons: Crowding there is the result of opposing currents of passengers from and to trains on the same platform. The trouble could be removed by placing a gangway along the west side of the structure, such as has been built along its east side; the outside platforms would accommodate south-bound and the inside platform north-bound passengers; but a permanent injunction prevents that. There is, however, another way of accomplishing the same result, viz.: by making the station a single direction station. If one current of passengers is taken away altogether the other one will find a free outlet. During morning rush hours the main current runs southward; the opposing current is formed by passengers coming principally from

the bridge and by a few from the street. During evening rush hours the main current runs northward. The opposing current is formed by passengers bound for the bridge and by a few bound for the street. In both instances the passengers to and from the street must be accommodated at the station. But the bulk of the opposing current, passengers to and from the bridge, may be removed by receiving and delivering them at the Chatham Square station of the junction line, which is located above the junction of the 2nd and 3rd Avenue Elevated Railroad lines with the elevated line from South Ferry and the West Side. The object for passengers to change cars rather at Chatham Square than at City Hall is avoidance of one change of cars between the bridge and the 2nd Avenue and South Ferry elevated lines, avoidance of the crush at the bridge and finding of an empty train. More effective would likely be the following stronger incentive: An eight cent transfer ticket between the Brooklyn and Manhattan elevated railroads good only for transfer at Chatham Square during the hours of 6 to 9 a.m. and 4 to 7 p.m. It might be sold in Manhattan from East and West 14th street southward. The Manhattan elevated railroad would gain thereby a large number of short rides, for which three cents would be sufficient compensation in the direction in which trains run light.

2. *The Trolley Terminals.*—The trolley line over the Brooklyn Bridge has during evening rush hours two kinds and two points of congestion: Passenger congestion at the Manhattan end and car congestion at the Brooklyn end of the bridge. Remedial changes should also afford relief for the congestion of the tracks in Fulton street, Brooklyn. During 22½ hours of the day, including morning rush hours, when arriving passengers disperse rapidly, the four-track loop terminal at the Manhattan end of the bridge meets all requirements; but during the hours of 5 to 6:30 p.m. it does not. Patrons of the 17 lines from Brooklyn have to wait for their cars, and there is not sufficient room for easy passage of those wanting to board cars through the waiting throng. The number of cars per hour being a fixed quantity, the only problem presented is, more room. It seems to be established that that cannot be had on the ground floor of the bridge premises; how and where it might be made available on the level of the mezzanine floor was pointed out by me to the interested parties; but there they do not want it. It must be found then outside of the present bridge terminal and there again the choice is narrowed down by the price of the property. Most available appears that strip of property bounded by the bridge, William, Frankfort and Rose streets, which can be bought for about \$250,000; average rate \$20 per square ft.

The project herewith, Fig. 2, proposes to leave the present loops intact and to operate them as now—for 22½ hours of the day. But during evening rush hours track 4 will be operated not as a loading track, but as a through

ton street are detained by those bound north on Sands street: a second track on the lower 300 ft. of the approach to be used by cars bound for Fulton street would confine the delay to north-bound cars; the approach to be widened for a driveway.

But the grade crossing at corner Sands and Washington streets can be avoided altogether in the following manner: The east-bound track to rise on an incline from a point near the river end of the Brooklyn approach eastwardly to a clearance of the bridge railway cars, thence crossing the bridge railway overhead to the northern road-

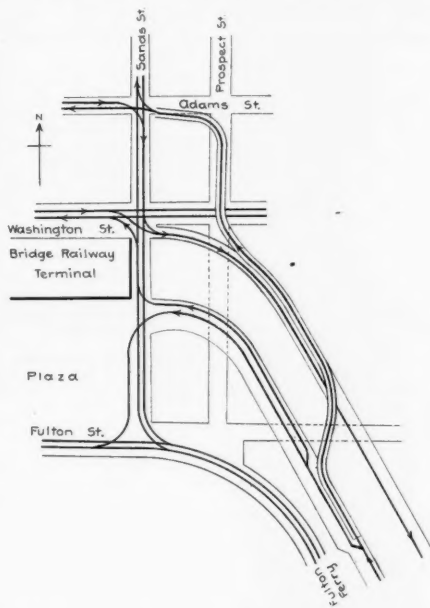


Fig. 3.—Proposed Trolley Changes at the Brooklyn Approach.

way, thence on elevated structure above the northern roadway of the approach to a point opposite Prospect street, thence elevated north in Prospect to Adams street and on private property to Adams street at grade. Operate over this viaduct all cars bound north on Sands street and bound east on Adams street, thus removing the grade crossing from the bridge entrance at corner Sands and Washington streets, where it is harmful, to corner Sands and Adams streets, where it will do no harm.

By means of this viaduct the pressure may also be taken off lower Fulton street, if cars destined for points northeast of the Adams, Willoughby, Boerum streets crossing in Fulton street are sent north in Sands and

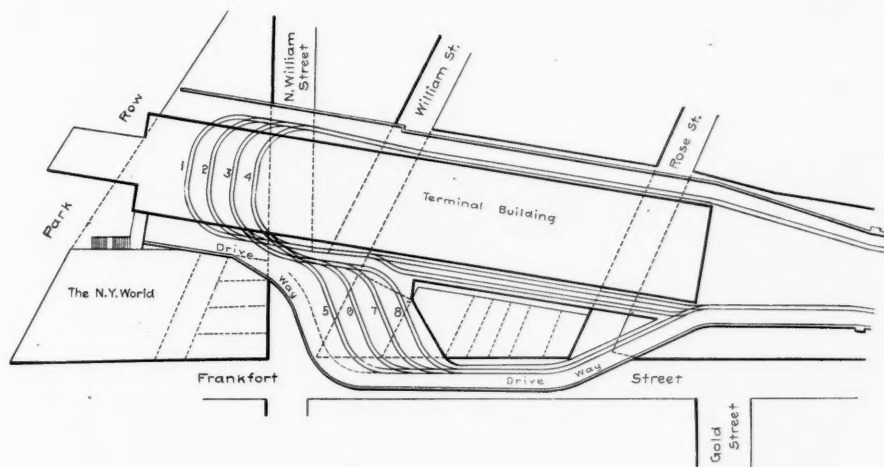


Fig. 2.—Meyer's Trolley Terminal for the Brooklyn Bridge—Manhattan End.

track to loops 5, 6, 7 and 8. Thus seven loading tracks will be obtained in place of four. For the emergency of a breakdown on track 4, track 3 is also connected with tracks 5, 6, 7 and 8. The grade crossing of track 4 with the main track does not introduce a new feature. The whole loop operation is a constant crossing at grade. Cars from track 1 east-bound cross in front of cars on tracks 2, 3 and 4, etc. The four new tracks are developed out of a second track, parallel to the east-bound main track, which is located on the present driveway. A new driveway had therefore to be provided. The vacated part of the present driveway is made use of for a siding for the side-tracking of broken down cars and a place where to locate during rush hours line repair men and material. The endeavor has been to get along with the least amount of new property. If the whole strip were taken the new loops might be laid parallel to the main track, or at any angle between that and the one shown on the plan and the driveway need not then encroach on Frankfort street. But, as shown, the plan offers the possibility of a further increase in the number of additional loops.

At the Brooklyn end of the bridge the car congestion is the result of the grade crossing of cars to and from the bridge and Fulton Ferry at corner Sands and Washington streets. Fig. 3. All the cars bound for Ful-

east in Jay streets, reaching Fulton street north of that crossing instead of passing it on their way from the bridge up Fulton street.

New York, March 20th, 1902.

Open-Hearth Steel in the United States in 1901.

The total production of open-hearth steel in the United States in 1901, including direct steel castings, was 4,656,309 gross tons, against 3,398,135 tons in 1900, an increase of 1,258,174 tons, or over 37 per cent. The production of open-hearth steel has more than doubled in the last four years, having increased from 2,230,292 tons in 1898 to the figures above given for 1901.

In 1900 our open-hearth steel production for the first time exceeded that of Great Britain, which then amounted to 3,156,050 tons. Great Britain's production in 1900 was the largest in her history. Our open-hearth steel made in 1901 was produced by 90 works in 14 States—Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Pennsylvania, Delaware, Tennessee, Alabama, Ohio, Indiana, Illinois, Wisconsin and Missouri. In 1900 94 works and 17 States made open-hearth steel. Neither Maryland, Kentucky, Michigan, nor Minnesota produced open-hearth steel in 1901, although all four

States were producers in 1900. Rhode Island made open-hearth steel for the first time in 1901.

In 1900 the production of open-hearth steel by the basic process amounted to 2,545,091 tons and by the acid process to 853,044 tons. In 1901 3,618,993 tons were made by the basic process and 1,037,316 tons were made by the acid process.

The total production of open-hearth steel castings in 1901, included above, amounted to 301,622 gross tons, of which 94,941 tons were made by the basic process and 206,681 tons were made by the acid process. In 1900 the production of open-hearth steel castings amounted to 177,491 tons, of which 42,644 tons were made by the basic process and 134,847 tons by the acid process.—*The Bulletin.*

A Handy Guide to Northern Securities Suits.

The various proceedings against the Northern Securities Company have been as follows:

I. Jan. 27, 1902, the State of Minnesota made application to the Supreme Court of the United States to be allowed to file a bill of complaint against the Northern Securities Company as sole defendant. This was based upon the provision of the Constitution of the United States that the Supreme Court shall have original jurisdiction of all suits by a State against citizens of another State. The claim asserted was that the organization of the Securities Company violated certain statutes of Minnesota prohibiting consolidation of parallel or competing railroads and also combinations in restraint of trade or commerce or interfering with open and free competition. Feb. 24, 1902, the Supreme Court denied the application upon the ground that the Northern Pacific and the Great Northern Railway companies were necessary parties; that the court could, therefore, grant no relief in their absence and that if they were joined the jurisdiction of the court would be defeated because those companies were citizens of Minnesota and the court would have no power to entertain a suit by a State against its own citizens. This proceeding is, therefore, at an end.

II. March 3, 1902, the Attorney-General of the United States filed in the Circuit Court of the United States for the District of Minnesota a petition in the name of the United States as complainant against the Northern Securities Company and the Great Northern and Northern Pacific Railway companies and various individual defendants claiming that the organization of the Securities Company constituted a violation of the Act of Congress of July 2, 1890, known as the Sherman Anti-Trust Act, upon the ground that it was a combination in restraint of trade or commerce among the several States and an attempt to monopolize a part of such trade or commerce. April 7 most of the defendants filed appearances in this case, and their answers will be due May 5.

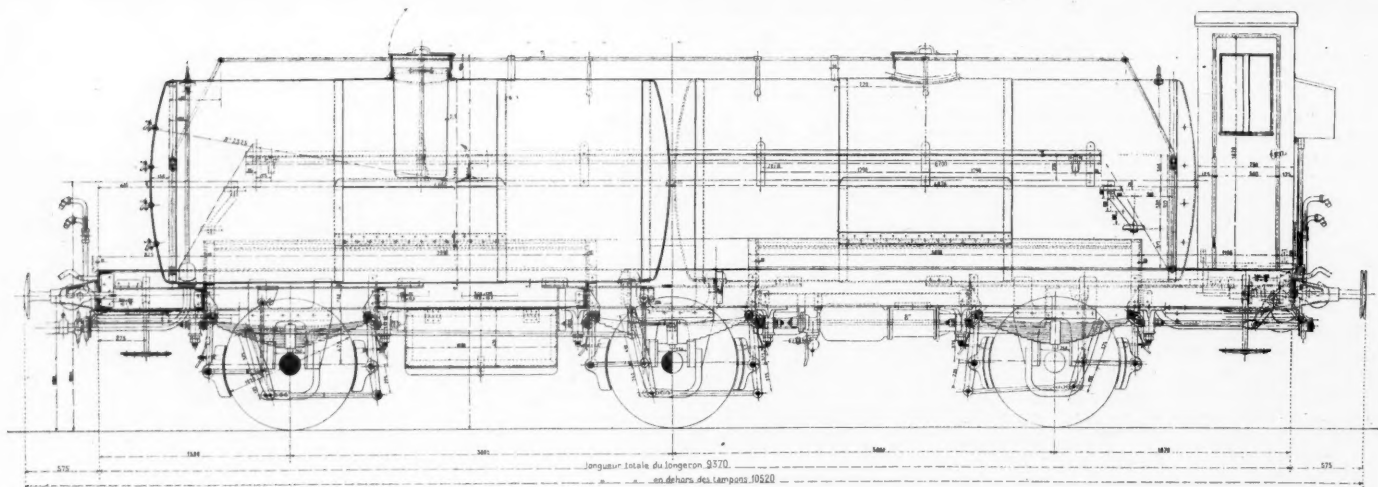
III. April 4, 1902, the State of Minnesota instituted a suit in the District Court of Ramsey County in that State against the Northern Securities Company and the Great Northern and Northern Pacific Railway companies. The grounds of this suit comprise those alleged in the aforesaid application of the State of Minnesota to the Supreme Court of the United States, and also a claim that the matter is within the Sherman Anti-Trust Act above mentioned. Inasmuch as the Northern Securities Company is not within the jurisdiction of the State, it seems unlikely that anything can be accomplished by this suit.

IV. April 7, 1902, the State of Washington made application to the Supreme Court of the United States to be allowed to file a bill of complaint against the Northern Securities Company and the Northern Pacific and Great Northern Railway companies. This proposed bill is substantially identical in its allegations with that sought to be filed in the Supreme Court by the State of Minnesota as above stated, and the Attorney-General of the State of Minnesota joins in it as counsel. The only important difference in the application is that the present claim depends not upon Minnesota statutes, but upon some Constitutional provisions of the State of Washington, and that the railroad companies are joined as defendants and, as neither of them is a citizen of the State of Washington, the questions of parties and of jurisdiction, upon which the Supreme Court acted in denying the motion of the State of Minnesota, will, therefore, not arise. The Supreme Court has announced that it will hear argument upon the question of allowing this bill to be filed Monday, the 14th inst.

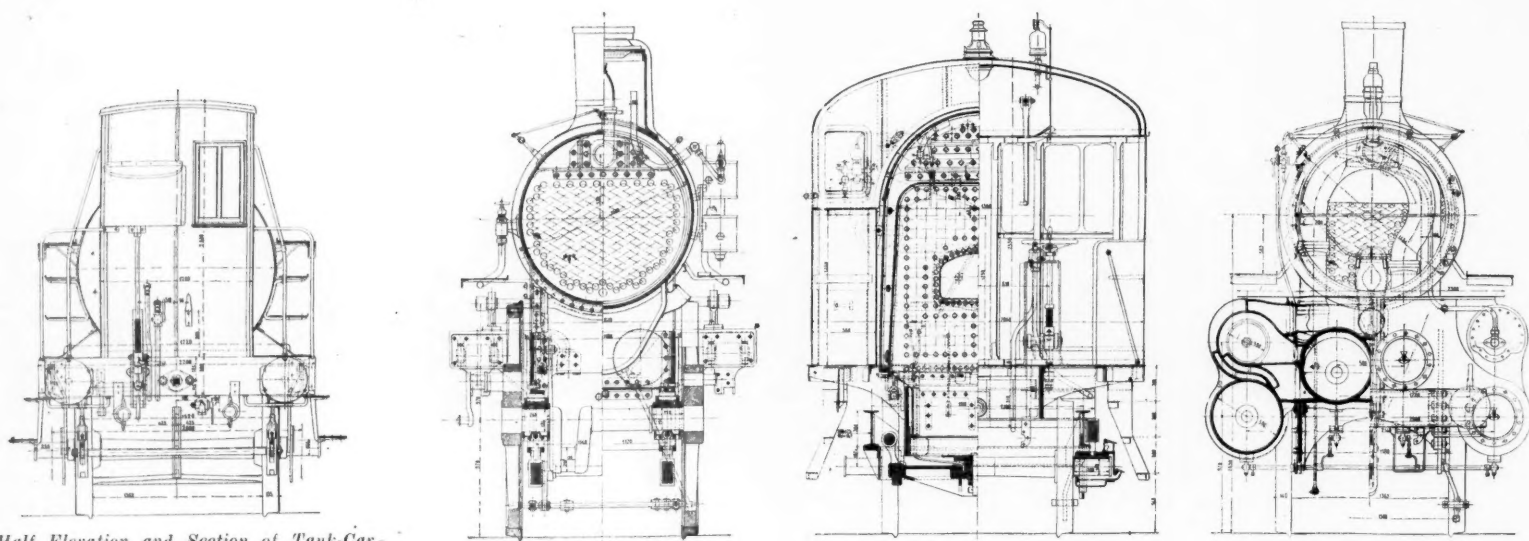
One suit is, therefore, now pending instituted by the Attorney-General in the name of the United States for the purpose of testing the question whether the case comes within the Federal Anti-Trust Act. Another suit is pending in the State courts of Minnesota upon the claim that the case is within the statutes of that State and also of the Federal Anti-Trust Act. An application by the State of Washington to be allowed to file an original bill is pending in the Supreme Court upon the ground that the case is within certain Constitutional prohibitions of that State.

In addition to the above, an action was brought last December in one of the State courts of Minnesota by one Peter Power against the Northern Pacific Company, alleging that said Power was the owner of 100 shares of the common stock of the company and seeking to enjoin the retirement of its preferred stock. A preliminary injunction was granted in the State court, the case was removed by the company to the United States Circuit Court and the injunction was vacated. The preferred stock was all retired upon Jan. 1 last. Nevertheless the plaintiff has proceeded to take testimony and the recent depositions of Messrs. Morgan, Schiff, Steele and others were taken in this action. The case has no direct bearing upon the standing of the Northern Securities Company, but is obviously being employed as a means of procuring information for use in the other cases and is, therefore, mentioned by way of explanation.—*New York Sun.*

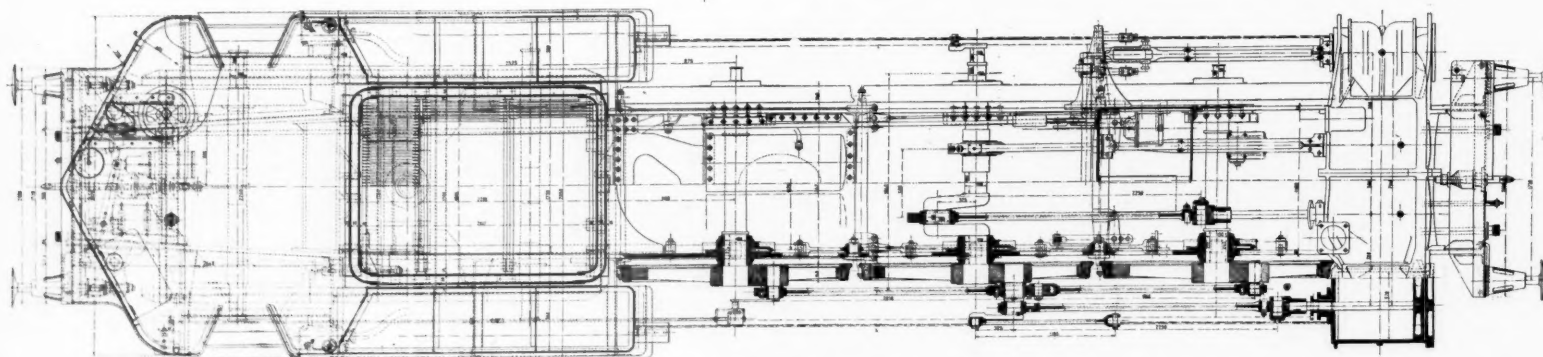
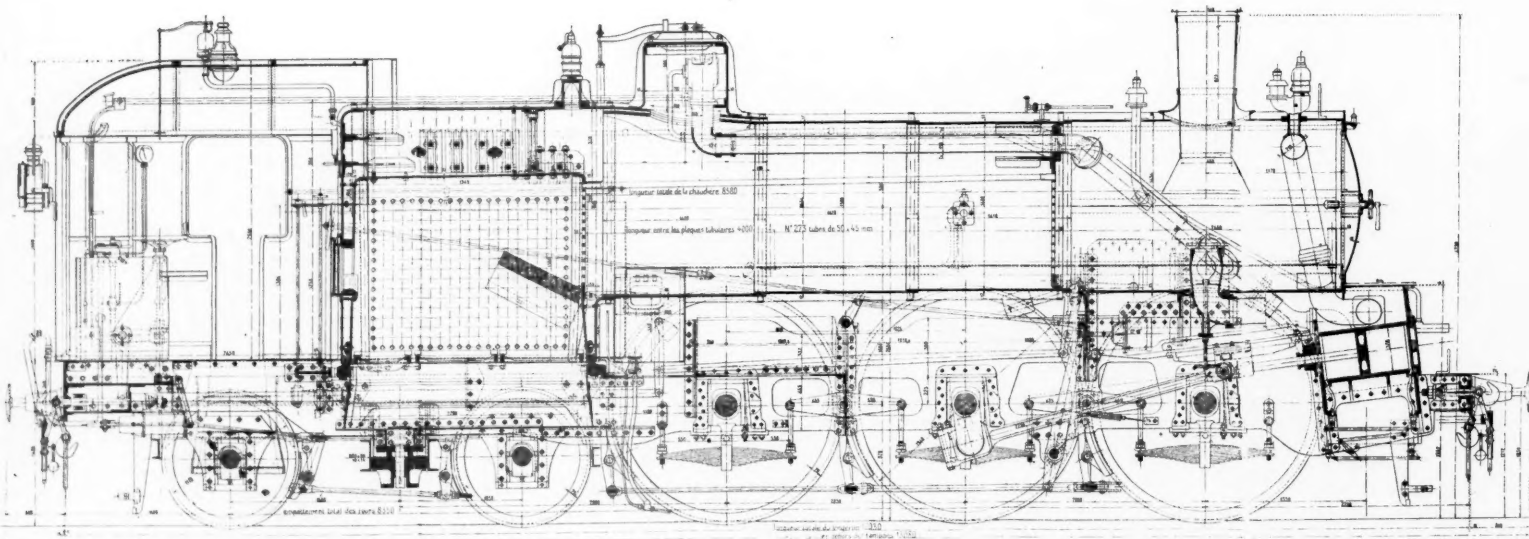
The Belgian Minister of Railroads has submitted to Parliament the report of the State Railroads for 1900. The activity of business and the Paris Exposition travel are reflected in an increase of 3.4 per cent. in gross earnings, and the rise in prices of coal and materials by an increase of no less than 18 per cent. in working expenses; so that the net earnings decreased from \$3,819 to \$3,212 per mile of road. There were 2,523 miles of road, and 62,134 employees—24½ per mile of road.



Water-Tank Car for Southern Railroad of Italy Locomotive.



Half Elevation and Section of Tank-Car.



Four-Cylinder Balanced Compound Locomotive—Southern Railroad of Italy.

A Four-Cylinder Compound for Fast Trains.

Of course the reader of the *Railroad Gazette* who is interested in locomotives will remember more or less definitely a four-cylinder compound engine which was shown at the Paris Exposition of 1900, by the Southern Railroad Company of Italy (Società Italiana per le Strade Ferrate Meridionali). The Chief Engineer of Motive Power of that company, Mr. Agazzi, having been attracted by a brief description which we published last Oct. 4, page 684, telling of the four-cylinder compound ten-wheel locomotive with crank-axes, recently

firing. To increase the grate surface it was found necessary to put the fire-box above the frames and put carrying wheels under it, which was arranged by the use of a bogie truck. [The reader will observe that the fire-box is at the forward end of this engine, with a four-wheel truck underneath; the smokestack being at the rear of the engine.] Thus it came about that the boiler was turned around on the frame, and the new locomotive looks like a tender locomotive designed to move with its fire-box forward. This arrangement as compared with other solutions that might have been adopted (for example, using a carrying axle at the other

two valve gears which ordinarily can be obtained only by the use of four valve gears. The cranks outside are put at 180 deg. relative to those inside and consequently two cylinders, that is to say, the outside cylinders have the passages crossed.

"The distribution of steam has been arranged so that the clearance spaces shall not exceed those generally used; and these spaces measured directly on the cylinders do not exceed 10 per cent. for the high-pressure cylinders and 7.5 for the low pressure.

"The passages are disposed in such a way as to keep in constant communication the opposite ends of two coupled cylinders. Thus uniform pressure is secured in the two coupled cylinders; and we have been able to compensate for the peculiarities of distribution due to the different angles which the two connecting rods form with their cranks.

"The starting apparatus is very simple, as is easily seen from the drawing.

"In designing this engine we have endeavored to avoid oblique strains on any of the parts, to use large dimensions for the journals, and for all moving parts, and to preserve great simplicity, endeavoring also to make very accessible all those parts which ought to be watched and lubricated.

"It should be observed finally that the braking effect of the Westinghouse air-brake, with a normal pressure of four kilograms (about 57 lbs. per sq. in.) in the pipes, corresponds to about half the weight of the engine, with a maximum of 55 per cent. on the driving wheels and a minimum of 35 per cent. on the forward axle of the truck."

The steam distribution is so arranged that admission is longer in the high-pressure than in the low-pressure cylinder. The cut-off is not equal between any two cylinders, but the difference between the high-pressure cut-offs is greater than the difference between the respective low-pressure cut-offs. The following table shows the points of cut-off in the forward motion for several positions of the block in the link.

| Distance of block from center of link. | High pressure cylinders. | | Low pressure cylinders. | |
|--|--------------------------|-------|-------------------------|-------|
| | 1 | 2 | 1 | 2 |
| .57 in. | 13.35 | 15.16 | 17.70 | 19.06 |
| 1.14 in. | 22.68 | 23.70 | 30.54 | 30.77 |
| 2.32 in. | 44.56 | 44.51 | 55.60 | 56.16 |
| 3.46 in. | 61.08 | 62.67 | 71.26 | 73.16 |
| 6.38 in. | 81.68 | 84.05 | 87.73 | 89.25 |

The figures give the per cent. of the stroke at which the cut-off takes place. The exhaust opens earlier in the high-pressure cylinder than in the low-pressure, but the latter remains open longer on the return stroke than the former. There is therefore some difference in the compression, that of the high-pressure cylinder being the greater, as it should be on account of the greater weight of the reciprocating parts.

Some of the principal features are given in the table.

General Description.

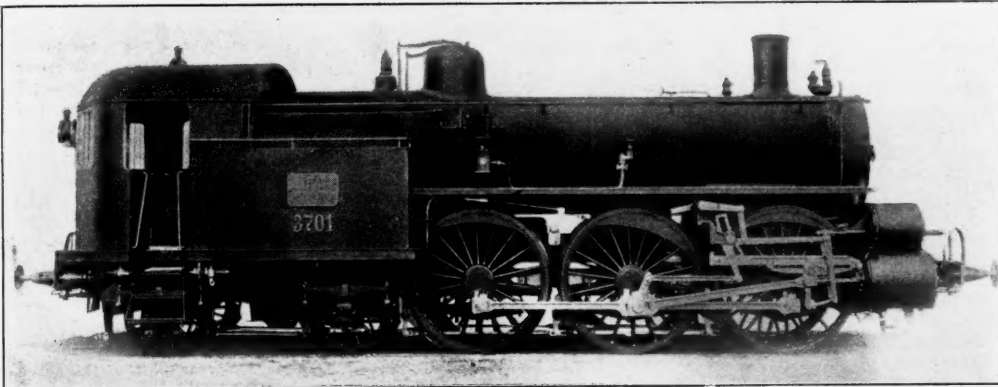
| | |
|--|--|
| Type..... | Ten-wheel 4-cylinder compound, with crank axes |
| Name of builder..... | Southern R. R. of Italy |
| Name of operating road..... | Southern R. R. of Italy |
| Weight on drivers in working order..... | 95,700 lbs. |
| Weight on truck wheels in working order..... | 50,600 lbs. |
| Weight, total, in working order..... | 146,300 lbs. |
| Weight tender, loaded..... | 63,800 lbs. |
| Wheel base, total, of engine..... | 27 ft. 4.74 in. |
| Wheel base, driving..... | 13 ft. 5.4 in. |
| Length over all, engine..... | 42 ft. 10.9 in. |
| Height, center of boiler above rails..... | 8 ft. 8.33 in. |
| Height of stack above rails..... | 13 ft. 11.32 in. |
| Heating surface, fire-box..... | 126.01 sq. ft. |
| Heating surface, tubes..... | 1,669.35 sq. ft. |
| Heating surface, total..... | 1,795.36 sq. ft. |
| Grate area..... | 32.31 sq. ft. |
| Drivers, number..... | 6 |
| Drivers, diameter..... | 76.38 in. |
| Truck wheels, diameter..... | 43.89 in. |
| Cylinders, diameter..... | 14.96 in. and 22.44 in. |
| Piston, stroke..... | 25.59 in. |
| Valve gear..... | Walschaert |
| Valves, kind of..... | Piston |
| Valves, greatest travel..... | H. P., 7.48 in.; L. P., 7.09 in. |
| Valves, outside lap..... | H. P., 1.34 in.; L. P., 0.98 in. |
| Valves, inside clearance..... | H. P., 0.2 in.; L. P., 0 in. |
| Boiler, working steam pressure..... | 211.5 lbs. |
| Boiler, material in barrel..... | Steel |
| Boiler, thickness of material in barrel..... | 0.67 in. and 0.71 in. |
| Boiler, diameter of barrel inside..... | 55.12 in. and 61.57 in. |
| Fire-box, length..... | Bottom, 6 ft. 7.4 in.; top, 6 ft. 4.57 in. |
| Fire-box, width..... | Bottom, 4 ft. 11.05 in.; top, 4 ft. 6.33 in. |
| Fire-box, depth front..... | 61.61 in. |
| Fire-box, depth back..... | 62.79 in. |
| Fire-box, material..... | Copper |
| Fire-box, thickness of sheets..... | Side, 0.59 in.; tube, 1.18 in. |
| Tubes, kind..... | Steel |
| Tubes, number..... | 273 |
| Tubes, material..... | Steel |
| Tubes, outside diameter..... | 1.97 in. |
| Tubes, length between sheets..... | 13 ft. 1.48 in. |
| Smoke-box, diameter..... | 56.46 in. |
| Smoke-box, length..... | 96.46 in. |
| Exhaust nozzle, variable or permanent..... | Variable |
| Exhaust nozzle, diameter..... | 7.48 in. to 4.02 in. |
| Stack, straight or taper..... | Taper |
| Stack, least diameter..... | 16.93 in. |
| Stack, greatest diameter..... | 20.08 in. |
| Stack, height above smoke-box..... | 4 ft. 11.05 in. |
| Type..... | 6-wheel or with swivel trucks..... |
| Tank capacity for water..... | 3,952 gals. |
| Coal capacity..... | 3.5 tons |

Standard Train Order Form E.*

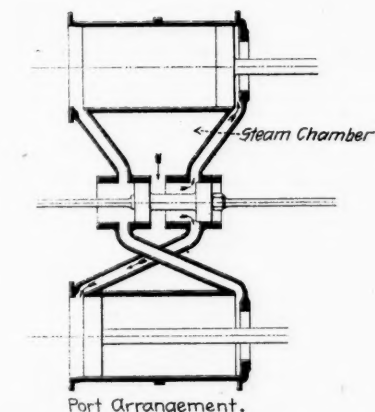
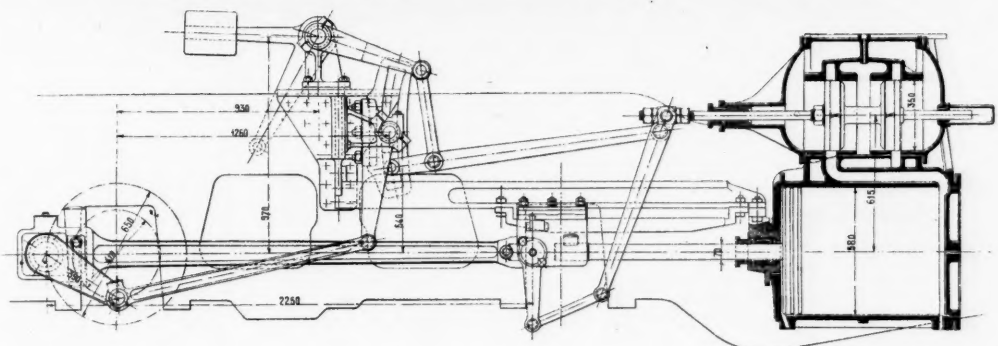
The question propounded is, What are the good and bad features of orders running a train so much late, as compared with orders instructing trains to wait at a designated point until a specified time.

To my mind, Form E (examples 1, 2 and 3), Standard Rules, has some good features; but the good ones are decidedly outweighed by the bad. In examples 1 and 2, when the train is required to run so much late between given points, we find an order which is the "despatcher's delight," being one easy to give; but the danger lies in the engineman computing time for himself, and the liability of his adding the wrong time to his schedule in his con-

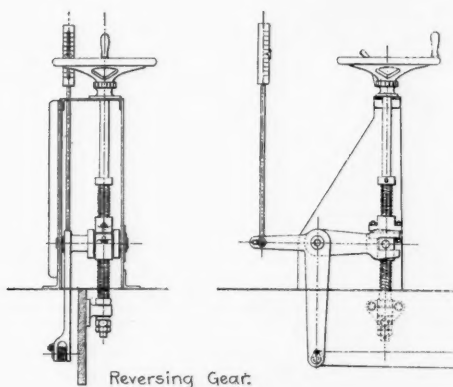
*A paper by E. P. Goodwin, Trainmaster of the Chesapeake & Ohio, read before the Richmond Railway Club, April 10.



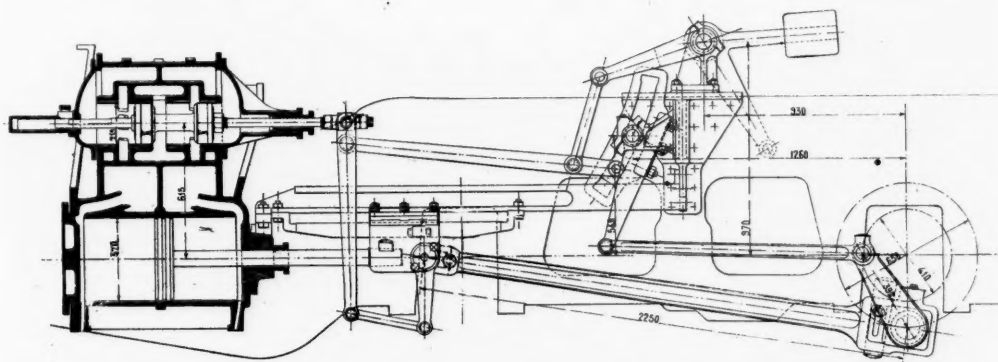
Four Cylinder Balanced Compound Locomotive—Southern Railroad of Italy.



Port Arrangement.



Reversing Gear.



Valves, Cylinders and Valve-Gear—Southern Railroad of Italy Compound Locomotive.

built at Baldwins for the Plant System, and illustrated and described in our issue of Feb. 28, has sent to us a description of the somewhat peculiar engine mentioned at the beginning of this article, sixteen of which were building when he wrote, two or three months ago. He informs us that the company is very well satisfied with the service of these engines. We have translated the description of this engine and reproduce such engravings as are necessary to show the peculiarities of its design. [Since the above was written we have official information that these engines go into regular service May 1.]

"For our fast service it was found to be necessary to provide greater boiler power in order to keep up the speed with heavy trains on broken profiles; but the limit of boiler power is in the grate. The width of the grate is restricted by the distance between frames, and its length is controlled by the possibility of effective

end of the locomotive), gives the advantage of a short total wheel base and, in our opinion, of great simplicity and stability.

"The arrangement of the fire-box compelled us to put the coal pockets on the locomotive itself, and one such pocket was placed each side of the boiler. The tender was thus reduced simply to a water carrier and has been made to take the form of a tank car.

"To avoid great dimensions in the engines proper and to give to the locomotive greater stability in movement without the use of excessive counterweights, it was decided to use four cylinders, two outside and two inside.

"The peculiarity of this locomotive consists in the arrangement of the cylinders, which are connected in pairs, the two high pressure cylinders on one side and the two low pressure cylinders on the other. In this way a single valve gear answers for each pair of cylinders without losing any of the independence of action of the

tinual comparison of watch, orders and time-table at each station. This order makes the engineman and conductor figure out their schedule, when the duty should belong to the despatcher.

Example 3 is a perfect order as far as it goes; but it only goes half way. It only provides for helping opposing trains, and cannot be used to help trains moving in the same direction. I would recommend that it be abolished, and the following substituted:

"FORM E—TIME ORDERS.

"No 4 will not leave Richmond until 5:45 p.m.
Ft. Lee 5:58 p.m.
Roxbury 6:13 p.m.
Prov. Forge 6:20 p.m.
Toano 6:45 p.m.

"A train receiving this order is required to run with respect to this time, as before required to run with respect to the regular schedule time."

This order places the calculations with the despatcher, whose surroundings, and possibly education, are better suited for this work than the surroundings and education of possibly five or six enginemen, who are each figuring for their individual train on the run-late order.

Aside from the standpoint of safety, better time can be made where advance figures are given to run by, instead of requiring the engineman to pick out the figures from one station to another. On railroads where numerals are used in train orders, and the numerals not duplicated in writing, the proposed form would not be a burden to the wires.

Railroad Shop Improvements.

There will be a great deal of work done this year in the way of shop improvements by many of the railroads. The largely increased business that nearly all of the roads have been experiencing has resulted in an increase of motive power and rolling stock, thereby creating a necessity for increased shop facilities. Beside providing more shop room, consideration must also be given to decreasing the cost of repairs, and careful attention is being given to this feature in connection with all shop improvements. The *Railroad Gazette* recently communicated with the leading roads in an effort to learn what is contemplated in the way of new shops and roundhouses, or overhauling and improving those already existing. A list of the replies has been compiled giving, briefly, work recently completed, that now under way, and work planned.

Atchison, Topeka & Santa Fe.—This road is rebuilding the shops at Topeka, Kan., and Albuquerque, N. Mex. The improvements are for the locomotive department. A number of new buildings are to be erected, including power stations for electric light and power. Electric drives and apparatus will be used in these shops.

Burlington, Cedar Rapids & Northern.—There is a probability that this road will build an additional shop at Cedar Rapids, Ia., and also enlarge the roundhouse at that point. This had not been determined definitely at the time of our information, nor what kind of power would be used.

Canadian Pacific.—Plans for large locomotive and car shops at Montreal, Que., were under consideration at the time of our advice. No particulars could be given.

Chicago & North Western.—This road has begun work on extensive improvements in its Chicago shops. During the spring and summer there will be added two new roundhouses, one having 39 stalls, and the other 24. In connection with the roundhouses new coal chutes and cinder pits will be provided, and an oil house, 20 ft. by 40 ft. The other new buildings will include a car erecting shop 102 ft. by 500 ft.; a locomotive paint shop 66 ft. by 200 ft., having a paint stockhouse 20 ft. by 40 ft. in connection; a blacksmith shop for the car department, 80 ft. by 300 ft.; also a dry kiln. All of these buildings will be brick. The new blacksmith shop is to have some new tools, and new tools are now being placed in the machine shop of the locomotive department. Electric drives will be used in all cases. In order to provide increased electrical power the foundation is now being built for a large unit composed of a 709-h.p. vertical, compound Allis engine direct-connected to a 500-k.w. General Electric direct-current generator. This new unit is intended to take care of the power, or day load, and the present plant will be used for lighting.

Chicago, Milwaukee & St. Paul.—Plans are being made for extensive improvements at West Milwaukee, Wis. It is intended to enlarge the various shops and drive the entire plant from a central power and lighting station.

Chicago, Rock Island & Pacific.—Large new car shops are being built at Horton, Kan., to replace those destroyed by fire in February.

Delaware, Lackawanna & Western.—This road contemplates the erection of new shops at Scranton, Pa., Buffalo, N. Y., and Kingsland, N. J. All work will be under way during the year. These shops will probably be driven by steam engines, although electricity may be used at one or two points.

Ft. Worth & Denver City.—New repair shops are now building at Childress, Tex. A description of these shops was published in the March 21 issue of the *Railroad Gazette*.

Great Northern.—Plans have been completed for large shops at St. Paul, Minn. There are to be five large buildings of steel and concrete construction, providing locomotive repair shops, storehouses, power station, etc. Electric power and lighting will be used and the estimated cost, including machinery, is \$350,000.

Illinois Central.—The shops at Waterloo, Ia., have recently been rebuilt and plans have been made for a new machine shop, 117 ft. x 200 ft., at Freeport, Ill. The improvements at Freeport will consist of extensions of the old shops and some minor new work, estimated to cost \$125,000.

Intercolonial Ry. (Canada).—Plans have been made for shop extensions and new roundhouse facilities at the principal division points.

Lake Shore & Michigan Southern.—New locomotives and car shops are now building at Collinwood, O.

Mexican Central.—This road commenced building entire new shops at Aguascalientes, Mex., some two years ago, to cost about \$750,000. The work is well under way, and will be continued during the present year. Electric light and power will be used in these shops.

Michigan Central.—The shops at Jackson, Mich., are being improved and extended, including the erection of a new machine shop, locomotive erecting shop and electric power and lighting station. A number of new tools will be bought for the various shops. The *Railroad Gazette* of Feb. 7 gave a brief description of these shops.

New York Central & Hudson River.—New shops are being built at Oak Grove, near Williamsport, Pa. They will include an erecting shop, blacksmith shop, wood mill, freight car shop, office building, oil house, and a 20-stall engine house with machinery annex. This latter has been completed. The plant includes a coaling trestle, ash pit, etc., and the engine house is heated by hot air.

Improvements are under way at the West Albany, N. Y., shops involving the building of a new erecting shop to replace the old paint shop, and a central power and lighting station for running the entire plant by electricity. A 60-stall engine house plant has recently been completed having a coal trestle; ash pits, steam heat, shop annex, and a turntable operated by gasoline motors.

A new carpenter shop and oil house are being built at Depew, N. Y. Other engine house plants recently completed or well under way are: Kingston, N. Y., 7-stall house with shop annex, steam heat and water supply; ash pits and mechanical coaling plant. Ravenna, N. Y., 19-stall house with shop annex, steam heat and water supply; coal trestle and ash pits. North White Plains, N. Y., 12-stall house with shop annex, steam heat, water supply and electric plant for lighting, operating mechanical coaling plant and pumps. Utica, N. Y., 22-stall house with shop annex, steam heat and water supply; ash pit and mechanical coaling plant.

Engine house plants authorized but on which work had not yet begun: Rensselaer, N. Y., 50-stall house with shop annex, hot air heat, and water supply; ash pit and mechanical coaling plant. De Witt, N. Y., additional 30-stall house with shop annex and hot air heat; ash pit and mechanical coaling plant. Clearfield, Pa., 8-stall house with shop annex, water supply, coaling trestle, ash pit, etc. Brewster, N. Y., 8-stall house with shop annex, water supply, coaling plant and ash pit.

New York, New Haven & Hartford.—The car shops at Readville, Mass., have been rebuilt, but were not yet occupied. These shops are equipped with electrical drives and apparatus.

Norfolk & Western.—About \$150,000 is being expended at Roanoke, Va., for shop improvements and at the time of our information it was expected that the work would be completed by the first of May. These improvements include additions to the present shops and the installation of electricity for power and lighting.

Oregon Short Line.—Entire new shops are now building at Pocatello, Idaho. They include a machine shop, boiler shop, blacksmith shop and wheel and truck shop under one roof, and a power house for heating and electric power and lighting; also an addition to the present roundhouse. A car shop and foundry are planned, but will not be built until later.

St. Louis & San Francisco.—A new woodworking shop 75 x 224 ft. has recently been built at Springfield, Mo.

Seaboard Air Line.—Work is under way on improvements at Portsmouth, Va., which include the building of a new foundry and enlarging the machine and erecting shop. The capacity of these shops is to be increased four locomotives a month, and machinery necessary for this increase will be added.

Southern Pacific.—Modern shops are to be built at Los Angeles, Cal., at a new location in that city, including a machine shop 250 x 120 ft. and a boiler and blacksmith shop of the same dimensions. New shops will also be built in a new location in San Francisco, Cal. They will consist of a machine shop about 250 x 120 ft. and a boiler and blacksmith shop 130 x 120 ft. Improvements are planned at Houston, Tex., and El Paso, Tex., in the way of extensions to the present shops; also at East Portland, Ore.

Southern Railway.—This road is building a new roundhouse and paint shop at Alexandria, Va.; a woodworking shop and car repair shed have recently been completed at that point. Electricity will be used for lighting.

Plans for extensive improvements at Sheffield, Ala., included the removal of the shops from Memphis Tenn., to that point. The buildings already at Sheffield are to be enlarged and practically new shops are to be built. Electric power and lighting will be used and the estimated cost of the work is \$100,000.

Terre Haute & Indianapolis.—Some improvements at the Terre Haute, Ind., shops were contemplated. At Logansport, Ind., a repair shop about 70 x 120 ft. is to be built; also another building for boiler, engines and a blacksmith shop.

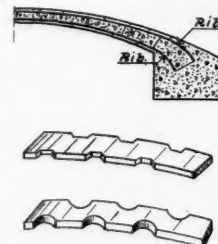
Union Pacific.—Work on new shops at Omaha, Neb., is

under way. A large machine and erecting shop 150 x 400 ft. will be completed first and then the other buildings will gradually be replaced by new ones. The old boiler shop building is to be converted into an electric power and lighting station. A large number of new tools will be added.

Wheeling & Lake Erie.—Improvements are to be made to the Norwalk, Ohio, shops in the way of extensions and the addition of new tools. Electrical drive and apparatus will be used and the work will cost about \$55,000.

A New Rib for Steel-Concrete Structures.

The cut shows a steel rib or reinforcement bar for concrete arch construction on which a patent was recently issued to Mr. K. S. Riser, Engineer of the Grand Rapids Bridge Co., Grand Rapids, Mich. The patent is for the combination of concrete with flat bars, the bars provided with notches or indentures in their edges. The object of these indentures is to increase the grip between the steel reinforcement and the concrete so as to avoid any slipping of the metal in the concrete by the weakening of the adhesion



through vibrations of the structure.

Flat bars are used because the indentures in the sides in this way can be rolled deep and large enough to be properly filled with concrete and, at the same time, they can be spaced far enough apart to give the necessary resistance to shear in the concrete (it is, of course, understood that the bars have a proper thickness for bearing). The indentures in the sides are also considered desirable because it is easy for the inspector and workmen to see that the concrete is properly tamped into the same.

As the bars are flat it is easy to connect the top and bottom bars with web spacers whenever desired, and it is also easy to connect the different ribs to each other with horizontal bracing or tie bars. These reinforcement bars are cheap to manufacture and as the indentures besides being rolled can also be punched, smaller orders of these ribs can always be easily and readily procured.

Foreign Locomotive Notes.

The Midland Railway of England have just put into service two compounds of a new design from the drawings of their Locomotive Superintendent, Mr. Johnson. They are of the three-cylinder type and are reported to have the high pressure 19 in. in diameter and the two low, 21 in.; the wheels are 6 ft. 9 in. in diameter, and the steam pressure is 195 lbs. to the sq. in. The tender is on two bogies and carries, for England, the large quantity of 5,000 imperial gallons. Official inquiries fail to procure any authentic information, though the above is probably accurate.

The introduction of larger engines on the English railroads for mineral and goods traffic is spreading. The London & North Western, Great Northern, the Great Eastern, the North Eastern, the Great Western and the Caledonian have all introduced either eight coupled or enlarged six coupled engines. The Great Western have in service some moguls having the same boiler as the large express engines. The introduction of high capacity wagons is not so easy, as there are no facilities for unloading them, though the London and North Western have now in use two trains of 20-ton cars for their locomotive coal haulage.

The Northern of France are now receiving the Atlantic type engines ordered after the successful results shown by the first pair, whose work has been mentioned in the *Railroad Gazette*. There are 10 in the order, and apart from small modifications they are similar to the first No. 2,641. The tender runs now on six wheels, and is fitted with a scoop for picking up water, though as yet the necessary troughs are not begun.

In the new express engines built for the Eastern of France provision is made for burning tar as an addition to the coal should there be any special demands on the engine. This is so arranged as to be fed through two nozzles above the fire, and is satisfactory in its actual working.

The Great Central of England is building a number of 10-wheel engines for the fast fish services from the coast to London, Manchester, and other towns. The chief dimensions are reported to be: Cylinders, 19 x 26; boiler, total heating surface, 1,750 sq. ft., outside diameter, 4 ft. 9 in., and the grate area 23 sq. ft.; the pressure is to be 180 lbs. per sq. in. The coupled wheels are 72 in. in diameter, and the truck 42 in. The tender will carry 3,250 imperial gallons.

The leading dimensions of the new express engines designed by Mr. Wainwright, locomotive engineer of the South Eastern & Chatham Ry., are: Coupled drivers wheels, 81 in.; heating surface about 1,600 sq. ft., and steam pressure, 180 lbs. per sq. in. The cylinders are

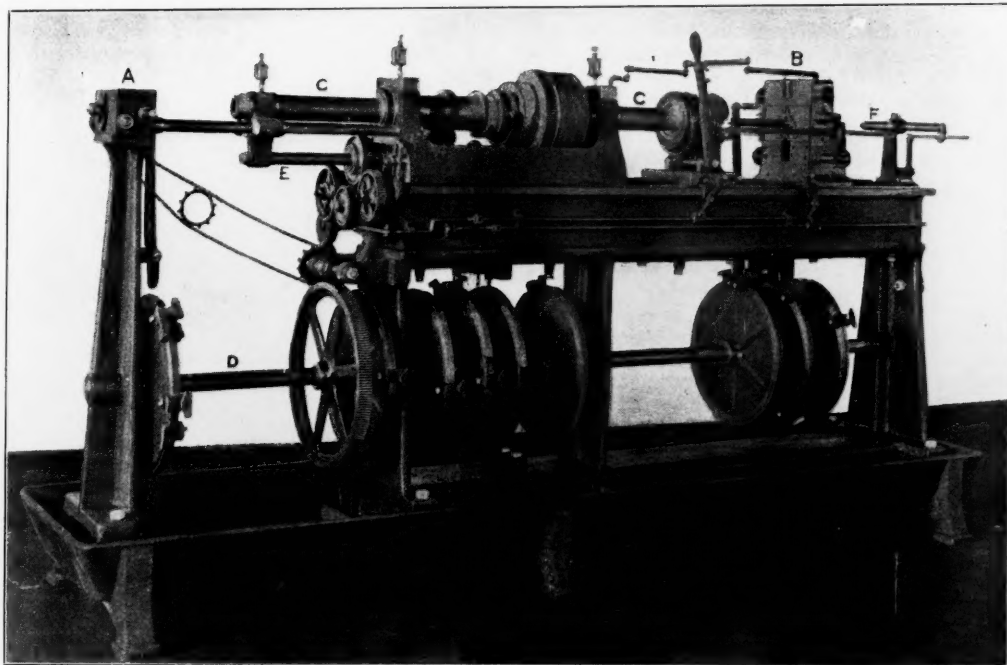
19 x 26. This is a great advance on any engines the South Eastern had. The much smaller engines of the Chatham, built by Mr. Kirtly, have done fine work though the modern loads are quite beyond them. R. HOPE.

An Automatic Staybolt Machine.

The engraving shows a recently patented machine for producing staybolts from the bar. The principal parts of the machine are, the rod feeding mechanism A, which is mounted on an independent standard; the main head B, the clutch jaw and the hollow shaft C. These parts are all actuated by the selecting devices, consisting of the disks and dogs, which are mounted on the shaft D. The rod feeding mechanism is of a friction type and is operated by a lever and the selecting device shown directly under it in the illustration.

The clutch chuck is located in the hollow shaft C. This is adjustable to different sizes of bars.

In the main head are located the cutting tools and their actuating devices; this is adjustably supported on the guides and is held in place by a clamp screw.



The A. W. Epright Automatic Stay bolt Machine.

The mechanism for producing the longitudinal motion of the bar is directly controlled by the screw E, which is connected to the hollow shaft C as shown.

The operation of this machine is as follows: The bar is passed through the rod feeding mechanism and into the hollow shaft. The selecting dogs on the disk which control the rod feeding mechanism act upon the lever which in turn engage the friction rolls with the bar. The bar is thus fed through the clutch chuck, which is open, and remains open until the end of the bar comes in contact with the adjustable stop *cgF*. When the bar comes in contact with the stop *F* the proper cams act upon the clutch chuck and grip the rod firmly to the hollow feed rod D. The bar is now in a position to be operated upon.

The feed screw, which imparts a longitudinal motion to the bar, is now put into play by means of the proper gears and cams. This is fed at a suitable speed for the cutting down operation to be performed in the center of the bolt. The cutting tool is now moved into place by means of the proper selecting devices, and the rods shown on the side of the machine.

After the body of the bolt has been cut down the cutting tool is withdrawn, and a backward motion is given to the bar. This motion is at a light speed as there is no cutting to be done until the end of the bolt reaches the threading dies. When this point is reached the speed is again automatically reduced. The end of the bolt now enters the threading dies which close at the proper moment upon it. After the thread is formed on the front end and while the thread-cutting dies are passing over the cut down portion of the bolt, a higher speed is again used, but immediately upon the entrance of the rear end of the bolt into the dies the speed is again reduced and the proper thread-cutting speed used. The bolt is now run back at a higher speed into the position for cutting off. The rod is now held in a stationary position as far as longitudinal movement goes, but still revolving. The cutting-off tool is brought into operation and severs the bolt from the rod. The cutting-off tool is then withdrawn, and the stop *F* is again restored to its operative position, the clutch chuck opened and the rod is again fed into position to start another bolt.

A number of these machines are in daily operation at the Juniata shops of the Pennsylvania Railroad at Altoona, where Mr. A. W. Epright, of the Pennsylvania Railroad, the inventor, would be glad to show them in operation.

A "trackless railroad" is the last German notion. On a short line in the Saxon Switzerland electric omni-

buses built by Siemens & Halske have been running over a macadamized road, getting their motive power from an overhead trolley wire, is if they were street cars. As there is no rail for the return current, two wires are provided instead of one. It is said to have worked well and a longer route is contemplated.

Some Aspects of Rapid Transit in New York.*

As I look back, I see that my own conception of Rapid Transit in New York has been narrow. A dozen years ago it seemed to me plain that the proposed underground rapid transit road could not pay interest on its cost. It seemed equally plain that private capital could not be induced to take the risk of building and working that enterprise, that the city must do it and the taxpayers must pay the yearly deficit. It seemed to me plain that the quickest way and the cheapest way, and so far as I could then foresee, the way sufficient for the needs of many years, was to better the elevated railroads. Looking back now over that dozen years I see that in some part I was right and in other part my

to extend lines into certain streets not now occupied. Why were these things not done? There are gentlemen here who can answer this question better than I can, but the greatest difficulty in the way was, no doubt, a wide and deep prejudice against the company.

This prejudice was mostly not deserved, for the service of the Manhattan elevated has been one of the remarkable transportation performances of the world. Its passengers have been carried with astonishing regularity; they are carried at a speed which is not likely to be largely increased for some years to come, and which could not have been much increased in the state of the art as it has existed in the years past. Its passengers are carried with greater comfort, under pleasanter conditions than I know of on any other line handling a great city traffic. Its passengers are carried with astonishing safety; during the years of its operation the Manhattan elevated has carried 2½ billion of people and it has never killed a passenger inside of one of its cars.

I do not say these things for the sake of saying something pleasant about the Manhattan elevated, but as bearing on the subject which I am asked to develop. The Manhattan has done these things in the past; it might have done much more in the past; it is capable of doing a good deal more in the future without adding anything to the length of its line, by the improvements which are now under way and others which may be cheaply made, if the city wishes.

What the Manhattan has done, the underground rapid transit road will do also, so far as the number of its tracks will permit. That it will do much better than the Manhattan has done in the past or any better than the Manhattan will do in the future is to be seen, but it will be an important addition to the transportation facilities of the town.

The elevated system of the Brooklyn Rapid Transit may be further developed on the lines that I have suggested for the Manhattan, and when the improvements are made in the means of getting its cars into and out of the Borough of Manhattan, there will be relief from present conditions in that direction.

Having examined so superficially the present conditions, we may now attempt to forecast something of the future. Captain Green will tell us what we may expect in the way of rapid transit to and from New Jersey. Mr. Baldwin will tell us of Brooklyn and Long Island; to what these gentlemen may say I need add nothing, except to say that it is most important to add to the east and west outlets, because the north and south lines must always be overtaxed. The great movement must be to the north. In all that beautiful country north of the Harlem, from the shores of Long Island Sound around to the Hudson River, the routes of travel lie like the sticks of a fan, converging to the north end of the island. In that region the population must increase fast until it becomes the densest suburban region in the United States, not only because of the attractiveness of the country, but from mere contiguity. It is the city marching northward. While the population of Manhattan was doubled in thirty years, the population of the Borough of the Bronx was multiplied by seven; and in the last ten years the population of that Borough has increased 148 per cent. Going further north we discover that the population of seven suburban towns on the Harlem Division gained 85 per cent. in 10 years; eight towns on the Hudson Division gained 41 per cent., and seven towns on the New Haven road gained also 41 per cent. This is a sample of what we must expect to the north, as the local means of transportation grow. In the Bronx, while its population was growing 148 per cent., the local movement on surface cars increased seven times.

But all the traffic converging from the north must now be wire drawn through the gateways of the island. This thought gives us the clue to a broad scheme of treatment. The northern gateways will have to be multiplied, the traffic will have to be divided north of the Harlem and scattered, not concentrated. This principle of distributing traffic and destroying the terminal idea is what some of us tried to apply last year to the Manhattan terminal of the Brooklyn bridge and it is the only philosophical principle for dealing with the traffic of great cities. We must cease to think of great terminals, and must divide the traffic while it is still in transit. Obviously this can be done on the North River by ferries and tunnels and on the East River by bridges and tunnels and ferries. But it can also be done at the north end of the island, even if the traffic cannot be distributed over a wide front.

I venture the opinion that the plan recently made public for improving the entrance to the Grand Central Station by an electrified suburban loop is only a temporary relief; it is founded on the principles of concentrating traffic into one terminal. The physical limit of the tunnel and of its tracks will soon again be reached. The congestion in the station and in the streets about the station will be relieved for a time, but before many years it will appear again. In the last ten years traffic in and out of the Grand Central station has increased 33 per cent.; I should suppose that the natural rate of increase for the next 10 years would be considerably faster, because of the rapid growth of the country to the north.

I do not for a moment suggest the abandonment of the Grand Central station, nor should I suggest any relaxation of attempts to improve the entrance to that station; this must always remain a valuable and useful station. But I venture to suggest that the suburban ques-

*Extracts from a speech by H. G. Prout at the annual dinner of the Transportation Club. A brief report of this dinner will be found in another column.

tion of the New York Central and of the New York, New Haven & Hartford, and of other routes that may yet be developed in the north, must be met by quite other means; by the application of the principle of dividing and scattering the traffic, while that traffic is still in transit. To that end the easiest way to improve the situation is to transfer the passengers while still north of the Harlem and preferably at two or three points, to the existing lines of the Manhattan elevated, and to the lines of the underground Rapid Transit road when that shall be completed and in operation. It must be kept in mind, however, that this implies more third track on the Manhattan and that the provision for express trains on the upper end of the new Rapid Transit is not sufficient to properly develop this plan. . . . This it appears to me is a simple statement of the broad and obvious principles on which the improvement must proceed, if we are to have adequate service between Manhattan Island and the beautiful and populous country to the northward.

Specifications and Tests for Rails.

In our issue of March 21, page 204, appeared nearly in full the report of the Committee on Rails of the American Railway Engineering and Maintenance-of-Way Association. The report got published a week earlier than we intended, and therefore as we gave it it was the original draft of the committee, which was changed somewhat before presentation at the meeting. The important changes were as below:

In the table showing the relative amount of rail rolled by the different mills to the American Society sections, there was an error in the original draft of the report, under the Maryland Steel Company. That Company rolled 52.1 of its 1901 product to the American Society sections.

In the general remarks on processes of manufacture, the committee struck out the sentence recommending that a larger bloom should be used for heavier patterns of rails.

Under the proposed specifications, section 3, physical properties, the word "fifth" was stricken out. Thus the committee now recommends that a drop test should be made on every blow of steel. The committee also recommends that the test piece shall preferably be taken from the top of the ingot.

In the original draft the committee had specified a shrinkage allowance of 6 in. for 85-lb. rail and 6 1/4 in. for 100-lb. rail. In the revision the committee left the number of inches blank, for reasons which appear in the discussions.

Extracts from the discussion follow:

RAILS.

Mr. Trimble: An editorial in the *Railroad Gazette* suggested that the rail committee of this Association might await the action of the rail committee of the American Society of Civil Engineers appointed at its last meeting. The appointment of this committee was agitated at our last meeting, and we felt that it would be hardly proper for us to go very deep into the subject of making special recommendations at this meeting. We think the advice is good, and it is probably the part of wisdom to wait a little longer in the matter of sections.

Concerning the "test in service" (*Railroad Gazette*, p. 205, first paragraph), Mr. Trimble said: I have no doubt a number of railroad companies will make this test or similar tests, and yet they do not feel that the information they obtain can be given to the public. We have made tests like this, using nickel steel, open-hearth steel, and the regular product, and we have found that on curves of about six degrees, a rail with about three per cent. nickel, which has been in four years shows comparatively little wear as compared with the regular rail that we have been getting. The regular rail on the same curve has been turned and we are now working on the other side of the head of that rail. That test can be carried through by any person who wishes to make it. You can take a rail made as Mr. S. D. Martin, of the Maryland Steel Co., recommends in the *Railroad Gazette*, or you can take a rail made by the Kennedy-Morrison process, and put these rails alongside each other and find out what they will do. As to whether you wish to furnish the results of the tests for publication, or to the Association, is a matter you must determine for yourself.

Of the paragraph on "heat treatment," Mr. Trimble said: As the practice in different mills is different, it is possible that we should specify the same shrinkage. For instance, in the direct-rolling as practiced in the Maryland Steel Co., it is claimed that they get the same results that are arrived at at the Carnegie Works, using the Kennedy-Morrison process; but the shrinkage at the Maryland Steel Co., to get the same results that you get at the Carnegie Steel Works, would be different, and for that reason these blanks have to be filled in depending on the mill where the rail is to be rolled.

The specifications are nearly the same as were recommended by the International Association for Testing Materials, Committee No. 1. We have a drop test on every blow of the steel instead of every fifth blow. We omit a portion of that paragraph which will be stricken out, on account of that modification of the number of drop tests. We have added the clause relating to heat treatment. We have added the one which specifies where the piece for the drop test shall be taken; that is, from the top of the ingot. I move the report be adopted.

Mr. Webster has called my attention to an addition that was made to the report of the International Association of testing materials at their last meeting at Niagara Falls in regard to the drop tests, which provides that: "The report of the drop test shall state the atmospheric temperature at the time the tests were made." The committee would like to have that added to this report at the end of paragraph 4.

We state that these specifications are not entirely satisfactory to us, but we think they are the best that can be had at the present time. Our reason for recommending the Association to adopt this specification at the present time is that we may get together and be able to work as a unit. At the last meeting there was information given to this Association which indicated there were about 115 railroads buying rails without any specification. There was another large number of railroads that did not have a specification, but asked the mills to give them the same kind of rail that was being furnished to the Pennsylvania Railroad, then there were other roads which asked for the same kind of rail which was being given to some particular railroad. It may be found in a year from now that we shall want to make an addition to the specification, and in two years from now we shall want to make another addition, and we feel it is better to have a specification that is not perfect than not to have any at all.

Mr. A. Torrey (Michigan Central): I think the phosphorus can be put lower and the carbon a good deal higher [for open hearth?—Editor.]

The stipulation as to variation of height I think should be 1/64 either way from the true section. If you do not put in such minute fractions, I think it should vary with the section which is called for under the specification.

As to the branding I think that should indicate the weight of the rail; that should be included in the specification.

The last part of stipulation No. 6 provides that: "A perfect fit of the splice bars shall be maintained at all times." I presume that means a perfect maintenance of the fishing dimensions.

Mr. Trimble: The committee would have no objection at all to amend the report in that respect; that is, change the variation in paragraph 6 to 1/64 in either case, but there may be some difficulty about it in the mills. That is one of the features in this specification which suit the mills possibly better than the railroads. We want to get the railroads to use this, and a little later on we will take steps to get a specification that fits the railroads better, and possibly not the mills so well. In regard to adding the weight of the rail to the brand mark, we will accept that amendment. Mr. Torrey is correct in the interpretation that a perfect fit means that the fishing angle shall be accurate for the splice bar.

I find that the Michigan Central is the only road that provides 1/64 variations of height over and under. The other roads have 1/32 over and 1/64 under. I think we would all like to have it 1/64 both ways.

Mr. Torrey: Two or three years ago I got a batch of rails 1/64 under mixed up with a batch of rails fully 1/32 over, and the results were not satisfactory. I had to separate them in groups.

I should like to be enlightened as to the propriety and the desirability of using the same chemical specifications for Bessemer as for open hearth. These specifications seem to imply that you could get rails of open hearth steel. Would you keep your carbon so low and phosphorus so high, when you could control both the elements?

Mr. Wm. R. Webster: The open-hearth steel was put in the original specifications of Committee No. 1 so that we would not be criticised in confining ourselves to Bessemer steel alone. The mixture given does not apply to open-hearth. If basic open-hearth is used, the phosphorus will be lower and the carbon run up higher, to give the equivalent hardness. It is immaterial whether you leave it out of the specifications now or not. But if you leave it out you may be criticised by indicating that you only want Bessemer steel. If you put it in, the mixture does not apply and the committee will give you a mixture that would apply to open-hearth steel. The Pennsylvania Railroad has recognized the matter of equivalent hardness by reducing the carbon and the manganese when the phosphorus runs up; that would be carried to a greater extent where your phosphorus is below .07 as in open-hearth steel.

Mr. W. C. Cushing: I would confirm Mr. Torrey's experience in regard to the variation in the height of rails. On the division with which I am connected we last year had precisely that same experience. Upon the inspector of the mill being called in to examine the rails, the statement was made that the rails became mixed in the loading, which, of course, implies that the mill must be very particular about how it loads these rails in order to have them come right. The cause of this variation is the wear of the rolls, and the more we cut down the limit on this wear of the rolls, the more expensive it is to the mill to roll the rails. But I am heartily in favor of what Mr. Torrey says, in trying to reduce these limits, instead of keeping them as at present. The rails which I speak of had such great variations that the riding of the track was uneven, and it was not discovered until a whole lot of the rail had been laid. It increases the wear in the case of a low rail following a high rail, because the jump of the wheel is much greater, resulting in a greater hollowing out at that point so that it really

is a matter of importance, and what we have heard shows that it is a mistake which the mill makes not infrequently.

Mr. Torrey: I move that 1/64 be substituted for 1/32 in clause 6.

Mr. Trimble: The committee will accept that amendment.

Mr. Torrey: I ask if the committee think it worth while to say anything in clause 10 which will secure straightened rails smooth on the head.

Mr. E. F. Wendt (P. & L. E.): I ask what the committee considers as a reasonable variation in the width of the base of the rail. I ask the question in view of the general use of tie-plates. In our practice we receive a large quantity of rails which vary 3/32, making it necessary to take this into consideration in designing the punch for the tie-plates.

Mr. Trimble: Mr. Abbott, of the Illinois Steel Co., a member of the committee, says that they could be kept to 1/16 of an inch, and that would be a reasonable variation in width. If that would be satisfactory to the members of the Association we will embody it in the specification.

Mr. Torrey: I move that the heading, "Chemical properties," be followed by the words, "For the Bessemer process." That won't do anything with the open-hearth except that we recognize that we can get open-hearth.

Mr. Trimble: The committee will accept that.

Mr. Torrey: In regard to the last sentence in paragraph 61 would move that it read "A perfect conformity of the fishing dimensions of the splice bars, however, shall be maintained at all times."

Mr. Churchill: It seems to me when you say the rails shall conform to the American Society section it should cover all dimensions.

Mr. D. W. Lum (So. Ry.): On many railroads they buy the largest section that they use, and want to use that rail on their main tracks, and for that reason it would seem to me that on page 7, paragraph 13, fourth line, the word, "seriously" might be left out; that is to say, that rails which contain any physical defects which impair their strength shall be rejected, so that there may be no question of the strength of the rail being impaired. It seems to me, there might be some question between the manufacturer and the inspector as to what would be considered a serious impairment.

Mr. Trimble: The committee is willing to omit the word "seriously."

Mr. Wm. B. Poland (B. & O. S. W.): The road with which I am connected some time ago purchased a large quantity of rails, and a large part of them were bowed. They had been straightened while not entirely cool and after they had cooled off they had contracted unequally and bowed up as much as half an inch in the length of the rail. I would suggest that not more than a quarter of an inch should be allowed in this particular.

Mr. Trimble: The committee thinks we ought to have straight rails. We do not care to admit any variation in this respect. We think you had better try to send these rails back and get straight ones.

Mr. C. S. Churchill (N. & W.): That point is covered by the inspector if he does his work right.

Mr. Trimble: In the base and in the head there is a different rate of contraction. The new committee of the American Society of Civil Engineers will probably fix this matter up for us.

Mr. Torrey: I suggest that paragraph 10 be amended to provide that rails shall be finished straight and finished while cold.

Mr. Trimble: The committee will accept that amendment, that the rails shall be straight when finished and shall be straightened while cold.

Professor Johnson: I inquired if I might say a word if I wanted to. Now that I find that I may do so, my mind is entirely at ease. The Chairman of the committee, instead of speaking of this as an imperfect specification, good until perfected, might have said that it is an incomplete specification, but very good as far as it goes.

Mr. Trimble: The chairman accepts the correction. "Incomplete" is what we had in view; not "imperfect."

Mr. W. R. Webster: I ask Prof. Johnson if he remembers some figures he submitted in connection with Committee No. 1, in regard to what he thought should be the drop test on a 100-lb rail? If I remember correctly you characterize 19 ft. as the fall of the drop, and said that theoretically it should be about 29 or 30 ft., and even that brought out differences in the quality of the steel in the open-hearth rail which was finished at a high temperature as compared with the quality of the steel in a lighter section, which was finished at a low temperature. I want to know if I am correct in these figures, because it has an important bearing on the shrinkage of the heavy rails. If we can get the mills to finish rails cool, we are going to get a better structure.

Prof. Johnson: I hope the committee will investigate this matter of the relative drops for the different weights to see that they are properly graduated. I do not think these relative weights are properly proportioned to the cross section. Taking the stiffness as a measure of strength of these different weights the relative drops as given here are really not properly proportioned.

Mr. Trimble: I think possibly we have covered that. Of course we had nothing before us to indicate whether they were the exact figures used or not, but we give in our report the information which is available, and we ask our members to adopt these suggestions which we

make and to obtain the information suggested in regard to chemical composition and shrinkage and other matters.

Professor Johnson: That does not quite meet the point. That simply means that we will ultimately get a lot of miscellaneous information, and from that miscellaneous information we cannot draw a wise conclusion. That is not a scientific way of attacking the problem. This matter should be investigated scientifically at some laboratory.

Mr. Duncan MacPherson (Canadian Pacific): Regarding paragraph 10 I should like to ask as a detail of manufacture, if it is possible to saw the rails cold. I laid 100 rails that were sawed square at the right angle to the rail, but they were not vertically straight. They were sawed when hot, and some were shorter on top than on the bottom. Is it possible, as a detail of manufacture, to saw them cold without adding to the expense?

Mr. W. R. Webster: It is not practicable, but in England and other places they sometimes specify that the ends shall be faced; if you should cut them cold, you would lose one of the most valuable checks you have in the manufacture of the steel, that is the shrinkage clause we have proposed. That is an absolute check on the temperature at which the rails are rolled. We are not prepared to recommend the amount of shrinkage which should be called for, but we know that the Pennsylvania Railroad has already obtained good results from it to date, and other roads will do the same.

Mr. MacPherson: With 100 lb. rail, a variation of $\frac{1}{8}$ in. is very considerable.

Mr. G. B. Woodworth (M. & St. P.): There is a variation of $\frac{1}{32}$ allowed in the rails which are received on the St. Paul road, which is lived up to. They are sawed hot.

Mr. MacPherson: Cannot there be some action on this clause 10 as to the variation in the ends of the rail?

President Kittredge: Will you make a motion to that effect, specifying the amount which you think proper?

Mr. MacPherson: I move that be added to the clause that the variation be not over $\frac{1}{32}$ of an inch.

Mr. Trimble: That is accepted by the committee.

Prof. Johnson: It seems to me that some heat of the average quality of rails should be rolled in these various sections, so that presumably you have the same material in these different sizes specified. Then let the rails, which presumably are of the same material, be tested for different heights of drop, to obtain the corresponding severity of abuse. That kind of information could not be obtained by simply gathering miscellaneous results, because the material is not the same. It is like any other scientific test; it has to be specially made, and the investigation specially designed and prepared in order to get anything that will be valuable.

Mr. Webster: I move that Prof. Johnson's idea be carried out, and that the Association make arrangements to carry out such tests as he referred to.

President Kittredge: That will come later. There is a motion before the house to accept the report and it is being discussed.

The report of the committee was adopted.

Construction of Elliptical Springs.*

The use of flat steel under railroad cars and locomotives in the form of elliptical or semi-elliptical springs has become, during the last 30 years, almost universal, especially under passenger cars and locomotives, but of all the details of which the modern equipment is composed, perhaps none has received less attention or serious consideration. The laws which govern the construction of such springs, to obtain the best results, not only in durability, but in other respects also, have been long known but are very seldom made use of in the proper way.

Many manufacturers guarantee the life of elliptical springs, which are constructed upon the crudest data imaginable and without the least inquiry as to the service, and many specifications are received by manufacturers defining conditions which cannot be complied with.

The cause of all trouble with elliptical springs, aside from poor material and workmanship, is found in an excessive deflection; i. e., a deflection which produces stresses in the material beyond its endurance. The deflection of a given size of steel is limited to an amount corresponding to the stress the material is able to endure without rupture, and consequently if this is exceeded failures will result. The deflection is therefore the paramount issue in the construction of springs. There are, however, three kinds of deflection which may be termed: Desirable deflection, permissible deflection, and possible deflection.

The desirable deflection is the amount a spring should be able to deflect in order to avoid shocks and produce good riding over a rough roadbed, and must be provided for in the construction of locomotives and trucks so that a sufficient amount of material of proper dimensions may be used. In the construction of modern engines and cars very little attention has been given to the space required for springs. This space is not any greater to-day than it was 20 years ago, although the weight to be carried has been doubled. Twenty years ago when the ordinary passenger coaches weighed about 45,000 lbs., and the Pullman cars seldom exceeded 70,000 lbs., the bolster springs were 40 in. long, composed of four or five plates,

and had a clearance of 4 in. between bands under static load. To-day coaches weigh 80,000 lbs. and over, and Pullman and special cars weigh 140,000 lbs., but the space allotted to the springs remains practically the same. As the space has not been increased, it became necessary to reduce the length of the springs and the clearance between the bands, and increase the thickness of the plates; and as a consequence the spring motion on modern equipment generally produces rougher riding than was the case with the old equipment, and if improvements have not been made in other directions it would be still more noticeable than it is. Engines and cars should therefore not only be designed for proper axles, etc., but also for proper springs.

The permissible deflection is the amount a spring may be deflected repeatedly without breaking or without changes in its original shape. The ability of a spring to deflect within safe limits depends entirely upon the proportions of the plates, which will be explained further on.

The possible deflection is the total distance a spring may have the opportunity to deflect if allowed to do so, and which is generally not provided for in the construction of the springs. In full elliptical bolster springs the possible deflection is the distance between the bands when free. This distance can be so proportioned to the dimensions of the plates that when the bands meet the material has not been overstrained.

In half or semi-elliptical springs, such as driving springs, for instance, the possible deflection is usually the distance between the top of the driving box and the under side of the frame. This distance may be much greater than the permissible deflection, and if the spring is permitted to deflect the entire distance it is sure to break or take a permanent set, either of which is equally objectionable. Constructors should therefore be so made that the possible deflection does not exceed the permissible deflection, and if this is impracticable in the ordinary construction of frames, etc., some means should be introduced which will accomplish the same results.

The extent to which a given spring may be deflected (the permissible deflection) depends upon several things, among which may be mentioned: First, the nature of the material; second, the distance between the supports; third, the thickness of the plates.

Of these the first mentioned is perhaps the most important, for without proper material the most careful calculations will not produce the desired results. The importance of the other two items is found by calculations, and is readily obtained with the use of the well-known formula on springs, by Reuleaux, which, on account of the limited scope of this paper, will not be repeated or explained here. These formulas show that the deflection is governed entirely by the length and thickness of the plates, and that the relative proportions between these two dimensions cannot be changed without a change in the deflection. A plate of a fixed length and thickness, or a spring of fixed length and thickness of plates, no matter how wide the plate may be or how many plates the spring may be composed of, has a well-defined (permissible) deflection which cannot be exceeded without destroying the material. The relations between deflection, thickness and length of plates must therefore be maintained within figures corresponding to the strength of the material in order that the best results may be obtained. That these relations are overlooked in the construction of springs for use under modern rolling stock the following examples will show:

A set of semi-elliptical driving springs in use on a modern locomotive have the following dimensions: Length, 42 in.; width of plates, 6 in.; thickness of plates, $\frac{7}{16}$ in.; width of bands, 4 in.; number of plates, 14; static load, 19,500 lbs. Calculations will show that the stress under the static load is 69,120 lbs., and that the springs must deflect $2\frac{1}{4}$ in. to carry the load. These springs are in service under locomotives having a clearance between the top of driving boxes and the under side of the frames of $3\frac{1}{2}$ in. On a rough roadbed or when running at high speed around curves the frames are likely to touch the boxes. The (possible) deflection to which the springs will be exposed is, therefore, $2\frac{1}{4}$ in. plus $3\frac{1}{2}$ in., or a total of $5\frac{3}{4}$ in.; and under this deflection the stress is 176,690 lbs., which is far above the ultimate strength of any known spring steel, at least for such purposes, and the result is that the springs either take a permanent set or the plates will break. Good spring steel should not be exposed to a stress exceeding 120,000 lbs.

In this particular case the breakages were so numerous and the engines rode so badly that the superintendent of motive power of the road was convinced that there was something wrong about the springs, and submitted a drawing of the spring rigging to a prominent spring manufacturer with the request that he should furnish a set of proper springs. It so happened, however, that the original springs for these engines had been furnished by this manufacturer; and the answer came back to the effect that if the load was as stated the original springs were correct, and no improvements were suggested. The difficulty with the springs is that the plates are too thick for their length to permit of the possible deflection, or the possible deflection is too great for the particular plates.

A tender truck spring has the following dimensions: Length between centers, 22 in.; width of plates, $4\frac{1}{2}$ in.; thickness of plates, $\frac{3}{8}$ in.; style of spring, triple elliptic; number of plates, 6; width of bands, 3 in. The specifications under which the spring was made provide a distance of $2\frac{1}{2}$ in. between bands with a load of 27,000 lbs. Cal-

culations will show that the stress in the material under 27,000 lbs. is about 67,550 lbs., and that the deflection under the same load is 1.28 in. They will also show that if the springs are deflected until the bands meet, or a total deflection of 1.28 in. + $2\frac{1}{2}$ in., or 3.78 in., the stress will be 199,380 lbs. Tender springs of the above description are known to have broken in service and have been renewed after nearly every trip the engines have made. The trouble with this spring is that the possible deflection is too great for the proportions of the plates.

The above two described springs are, as said before, not imaginary or uncommon examples, but are springs generally in use on all railroads and are furnished as part of the equipment of what, in other respects, may be considered up-to-date locomotives and cars. They are therefore fair examples of the fact that the possible deflection has not been given consideration.

Before describing the method that should be followed in the calculation of springs a few explanations may not be amiss:

Springs, as said before, are used on account of their ability to absorb through deflection sudden increases of loads and to regain their original shape when the excess load has been removed, thus avoiding violent shocks. The greater the distance through which a spring can deflect, the longer is the time in which the load is fully applied and consequently the less severe is the shock. The more sensitive they are to any variations in the load, the easier the vehicle will ride. The nearer a spring is loaded to the elastic limit of the material, the slower, longer, easier and more uniform are the vibrations. When deciding, however, as to how near the stress under the static load may approach the static limit, it must be borne in mind that if it is too near the limit very little additional deflection can be obtained before the elastic limit is reached and the usefulness of the spring is destroyed. Practical tests have demonstrated, however, that a stress under the static load of 60 per cent. of the ultimate stress of the material is permissible and will leave sufficient margin, in the majority of cases, for the absorption of ordinary shocks.

With these explanations the proportions of a spring

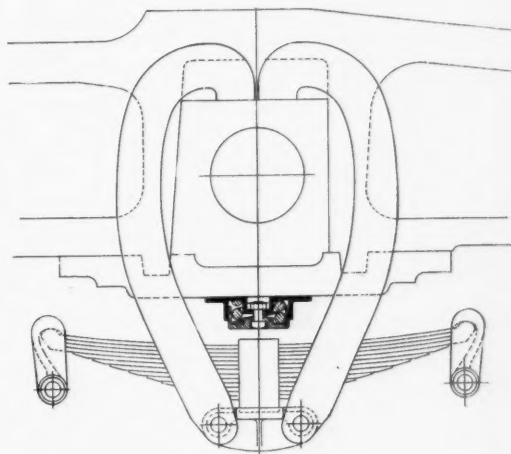


Fig. 1.

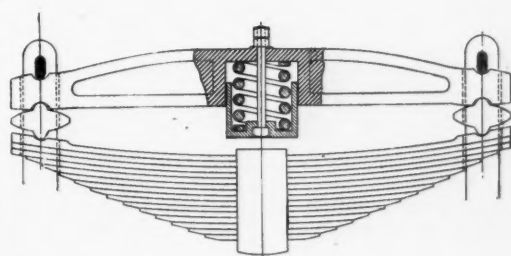


Fig. 2.

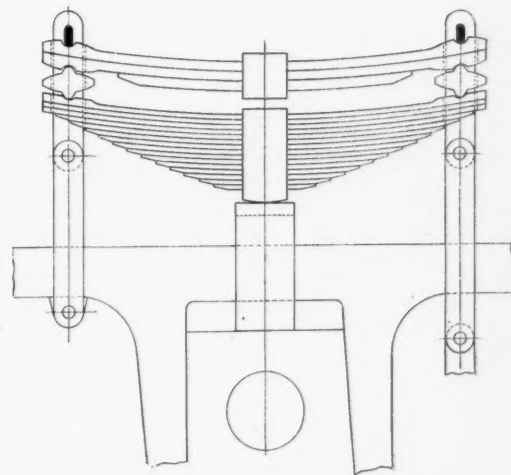


Fig. 3.

*Extracts from a paper presented by Mr. Charles A. Lindstrom, Mechanical Engineer of the Chicago & Alton, before the April meeting of the Western Railway Club.

may be obtained as follows: Assume the static load to be a fixed percentage of the final permissible load, with the elastic limit. If this percentage is taken as 60, then it follows that the deflection under the static load is also 60 per cent. of the total deflection and that a further deflection of 40 per cent. is all that can be obtained. Therefore, if, as in the first example, the clearance between the top of a driving box and the frame is $3\frac{1}{2}$ in., and the condition of the roadbed is such that the frame may be depressed until it strikes the box, then the $3\frac{1}{2}$ in. should be considered as the 40 per cent. and the total amount which the spring must be able to deflect will be $8\frac{7}{8}$ in. The total deflection for truck springs, as in the second example, may be obtained in a similar manner, except that the clearance between the bands under the static load should be considered as the 40 per cent. of the deflection.

With the total deflection known, it is only necessary to find the relative proportion of a plate that may be deflected the required amount, without overstraining the material, and while no formulas are given here it may be stated that the width of the plate has no value in this calculation and that the deflection is governed entirely by the thickness and the length, and that if the length of the spring is fixed by features in construction which cannot be changed, as is generally the case with driving springs, then a suitable thickness of the plate is the only thing to be found. After the thickness is determined the next step will be to calculate the carrying capacity of the plate per unit of width, which may be taken as 1 in., and then divide this capacity into the total capacity that the spring must carry, and the quotient will give the total width of plate required. The width so found may then be divided into any number of plates of a width best suitable to the requirements.

The proper thickness and number of plates in the spring described in the first example, the allowable maximum stress in the material being 120,000 lbs., and the stress under static load, 60 per cent. of the maximum, would be: Thickness of plates, about 0.2 in.; capacity of each plate, 516 lbs.; number of plates, 63; height of plates, 12.6 in. A spring of this kind is, however, in most cases impracticable: First, because the plates are too thin, and, second, because the combined height of plates is too great.

As the thickness of plates cannot be increased without a corresponding increase in the length of the spring or a reduction in the total deflection, and as, invariably, the length of the spring cannot be increased on account of limiting conditions as to wheel base, etc., it follows that the only remedy must be found in a reduction of the possible deflection, i. e., to introduce a positive limit within the elastic limit beyond which the spring cannot be forced.

The suggestion was made at one time to a locomotive firm which was building a new class of engines that it would be advisable to reduce the clearance between the top of the driving boxes and the under side of the frame, to an amount corresponding to the maximum deflection of the springs. The answer was given "We never build locomotives with less than our standard clearance!" The question was then asked, "What is the use of this clearance if it is instrumental in breaking the springs?" To which the answer was made, "We never thought of that." Nevertheless the standard clearance was made.

Now of course it would not be good policy to allow the box and frame to strike each other, as that would make rather rough riding; the idea was therefore evolved to introduce a yielding resistance which would assist the springs to carry excessive loads and finally, if necessary, stop any further deflection without violent shocks. Fig. 1 shows such a resistance as applied to an underhung spring rigging, and Figs. 2 and 3 show similar devices applied to springs above the frames.

With each of these devices the locomotive will, under ordinary conditions, be carried as usual on its ordinary springs, but when low joints are encountered, or rough roadbed generally, the auxiliary springs will come into action and assist to carry the load; and in case the increase in load should be too great, further deflection will be stopped by the auxiliary springs becoming solid, but without serious shocks and without breaking the springs. The auxiliary springs may be given any desired initial tension, the magnitude of which is best determined by experiments, and may be varied on different roads, or different conditions, according to roadbed or speed of trains. Devices of this kind are in many cases difficult to apply, especially on old locomotives, on account of a lack of space, but there is no reason why they should not be made use of in new constructions.

If the device shown in Fig. 1 is made use of for the engines described above, the springs may be made of 18 plates $\frac{3}{8}$ in. thick; the clearance between the main spring and the auxiliary spring may be made 1 in. and the auxiliary spring may be made to compress $\frac{1}{2}$ in. after coming in contact with the main spring, under which conditions the maximum stress in the main spring will not exceed 120,000 lbs., and the life of the spring will be indefinitely prolonged, besides which the engines will ride easier on account of the more flexible plates.

Bolster springs for passenger cars and tenders should be designed with a clearance between the bands under static load of not less than 3 in. for the former and 2 in. for the latter, and the plates should be so proportioned that the stress will not exceed 120,000 lbs. when the bands meet. In order that such plates may be used, the space allotted to the spring must be made wider or higher

so that the spring may be made wider or that more plates may be used.

The springs referred to in the second example have been replaced with springs 28 in. long, made up of 10 plates $\frac{5}{16}$ in. thick, but in order to get these springs under the trucks the column bolts had to be lengthened and the spring planks dropped down 2 in. The new springs have been in service for three months without a failure, whereas the other springs would break nearly every trip. When new trucks are built proper provision should be made for the springs.

Forty-ton Steel Frame Box Car, Norfolk & Western Railway.

There is evidence that the car with a steel frame is the car of the future for interchange traffic, when once its advantages have been demonstrated. Members of the Master Car Builders' Association have been at work on this problem for some years, and it will be remembered that in 1896 a committee of five was appointed to submit competitive designs for the steel underframing of freight cars. Of the designs submitted to the convention of 1897, there were two adapted for use under box cars. In neither case, however, was metal used for the upper framing. The latter was of wood, with the posts and counterbraces stepped in castings fastened to the sills.

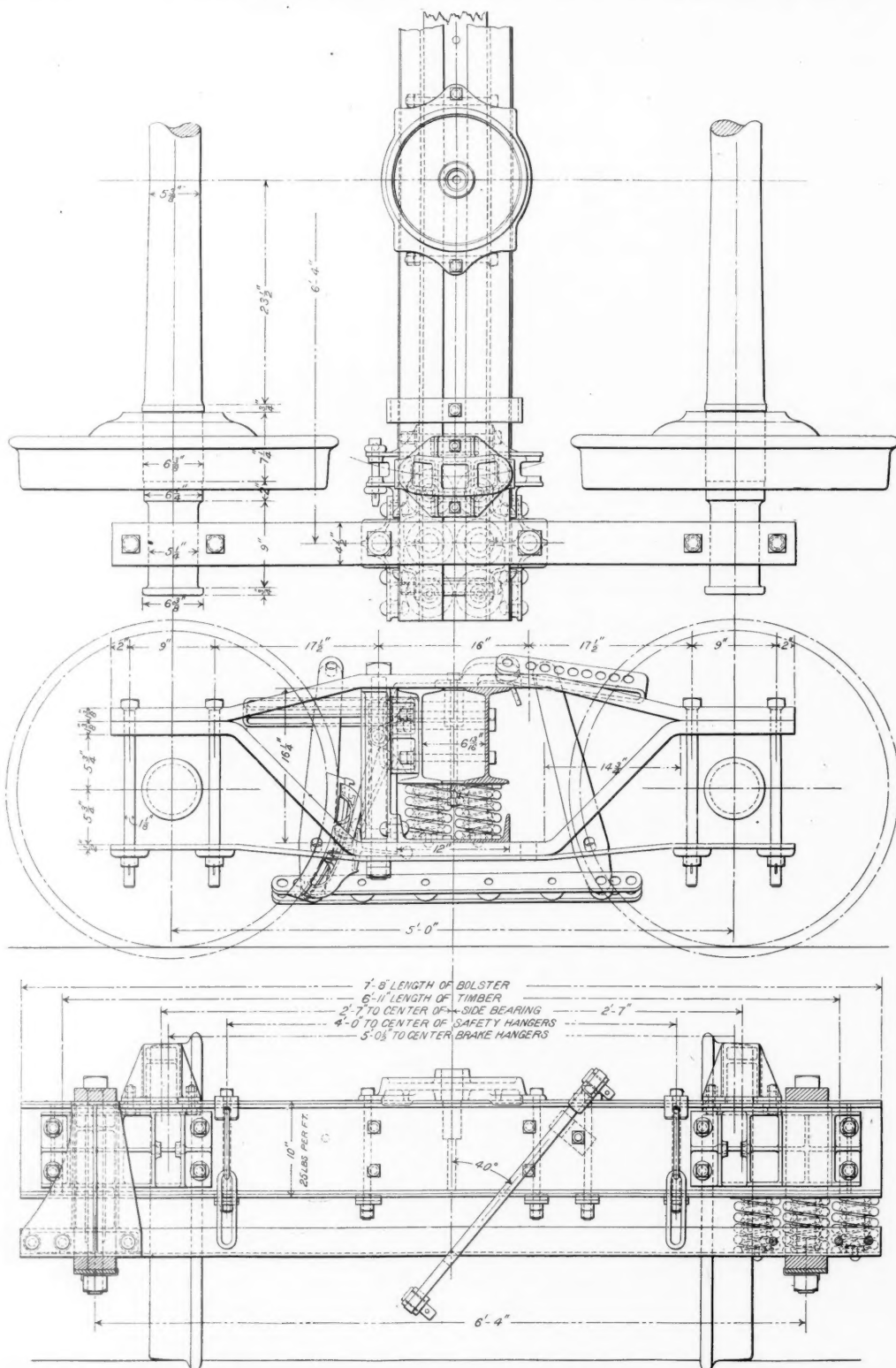
Some of these designs were adaptations of cars that had rendered satisfactory service, but we are not aware that any of them were ever applied to box cars.

One of these designs was from the Roanoke shops of the Norfolk & Western and here we find a number of cars now ordered having both the under and upper framing of steel. The car, illustrated herewith, is in a line

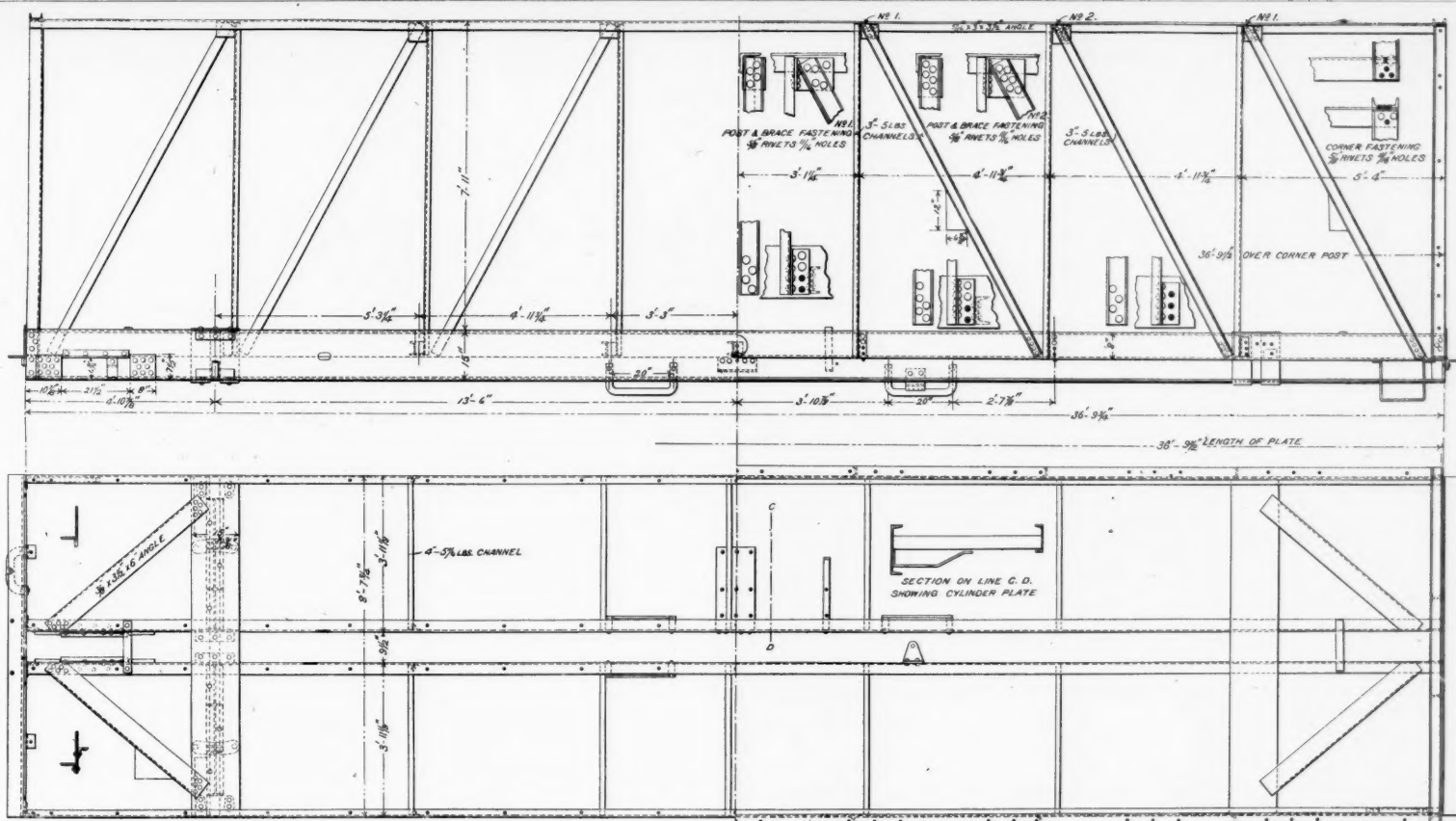
with the work that has been done by the motive power department of the Norfolk & Western, which, during the past three years, has brought out several designs of composite cars to be used in the coal traffic. These cars are all classed as high capacity—that is, their loading ranges from 40 to 50 tons.

The box car of 40-ton capacity is the most recent piece of work in this direction, and is built of structural steel with wood for sheathing, lining and roof. The car is known as of the "B G" class and has the following general dimensions: Inside length, 36 ft.; inside width, 8 ft. 6 in.; inside height, 7 ft. 6 in.; distance between truck centers, 27 ft. The weights and sizes of the principal members of the steel frame are as follows: Center sills, 15-in. channels, 33 lbs. per foot; side sills, 8-in., 11 $\frac{1}{4}$ -lb. channels; ports and braces, 3 in.; 5-lb. channels; corner posts, 3-in. x 4-in. x $\frac{3}{8}$ -in. angles; end posts, 4-in., 7 $\frac{1}{2}$ -lb. I-beams; side plates, 3-in. x 3 $\frac{1}{2}$ -in. x $\frac{5}{16}$ -in. angles; end plates, 4-in., 5 $\frac{1}{4}$ -lb. channels; underframe diagonal braces, 6-in. x 3 $\frac{1}{2}$ -in. x $\frac{3}{8}$ -in. angles; intermediate sill supports, 4-in., 5 $\frac{1}{4}$ -lb. channels; center and side sill connections, 4-in. x 4-in. x $\frac{1}{2}$ -in. angles; bolster and sill connections, 3-in. x 3-in. x $\frac{3}{8}$ -in. angles.

The body bolster is in design similar to those that have previously been used on the same road under the steel hopper and gondola cars of 40 and 50 tons capacity. It consists of a top plate measuring 15 in. by $\frac{3}{8}$ in. and two bottom plates $\frac{3}{4}$ in. by 6 in. with malleable iron fillers securely riveted together and attached to the center sills with angles. Attention is called to the peculiar construction of the compression member of this bolster. The top plate is bent down with as short a radius as possible, presumably from $\frac{3}{16}$ to $\frac{1}{4}$ inch on the inside, and the bottom plate is then cut to such an exact length that, when bent, the ends butt squarely into the corner of the



Standard Truck for 80,000 lbs. Capacity Box Car—Norfolk & Western Ry.



Side Elevation and Plan of Steel Framing for Box Cars—Norfolk & Western Ry.

top plate when in position. This seems to be a good deal of refinement for this class of work; but, in its practical application, no difficulty has been experienced in getting the two parts to come together with the closeness of fit that is desired. No work is done on the fillers other than to grind off the lumps. It will be seen that the side sills are carried by the upper flange and the rivets passing through the web and the vertical portion of the top plate of the bolster, a brace being brought out to the lower flange to prevent buckling. The malleable fillings are light and strong and the bolster is rendering most satisfactory service. Rivets are used wherever it is possible. The intermediate braces are riveted directly to the side sills, but the posts are turned so as to secure lateral strength to the sides and are secured to an angle on the side sill. The upper ends of the posts and braces are

The trucks used under these cars are of the diamond type that has been used as a standard under all of the 40-ton equipment. The bolster is rigid and is composed of two 10-in. 25 lb. I beams, and the spring plank is a channel weighing 20.5 lbs. to the foot. The arch bars have a thickness of $1\frac{3}{8}$ in., the tie bar $\frac{1}{2}$ in., while the common width of the three is $4\frac{1}{2}$ in. The oil boxes are of the M. C. B. standard pattern, but the journals are $5\frac{1}{4}$ in. in diameter by 9 in. long, this being the standard size used under both the 40 and 50-ton equipment on the road. Cast-steel flat bottom center plates are used, but the majority of the other castings in the truck are of malleable iron. The brakes are hung from the bolster and are consequently above the springs, a condition that is difficult to obviate in trucks where, as in this instance, no transoms are used. The truck is thus held square by the spring plank, a condition that, while common practice upon high capacity cars to-day, would have been considered an impossibility and dangerous a few years ago. The compression bar connecting the lower ends of the brake levers is also worthy of notice. It is formed of two flat $\frac{1}{2}$ in. by $2\frac{1}{2}$ in. bars riveted together with cast-iron washers as separators between. At each end there are

three pin holes for brake adjustment so that either beam may be adjusted independently of the other, or both may be adjusted together by the pin at the upper end of the dead lever. In regard to the other details of the truck such as the arrangement of springs and the like these are clearly shown by the accompanying engravings.

One of these cars was built some months ago and now 100 are being constructed for service where they will be allowed to work out their own salvation and demonstrate their commercial value. They will weigh, when new, 38,000 lbs., or 32.2 per cent. of their total loaded weight. The absence of truss rods and needle beams gives them a clean and trim appearance underneath and they are easy of inspection. They are fitted with the Wagner flush car doors, McGuire grain doors, Chicago roofs, Chicago couplers, Norfolk & Western standard tandem spring arrangement, Westinghouse air-brakes and Norfolk & Western standard brake-beams.

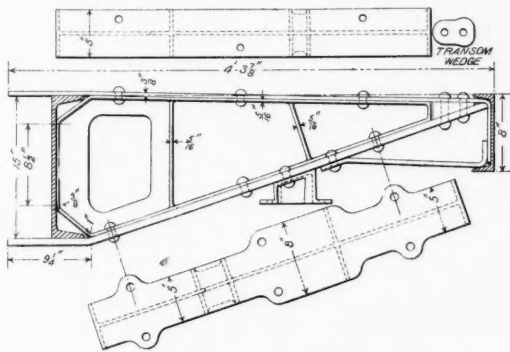
The design was made by Mr. C. A. Seley, Mechanical Engineer of the road, under the supervision of Mr. W. H. Lewis, to whom we are indebted for the drawings and information.

Foreign Railroad Notes.

A report has been spread in Germany that the Prussian Ministry would ask the Diet at its next session for authority to expend 500,000,000 marks (\$119,000,000) for building and improving old railroads, in order to give employment to the workmen whom the hard times have thrown out. This is now denied; but it is intended to push through considerable work already resolved upon, but which it was not expected to do so soon if times had continued prosperous. How much will be required for this is not yet known.

The long river routes are not all in America. The Danube Steamboat Co. has boats plying from Ratisbon to the mouth of the Danube, a distance of 1,455 miles, and navigates branches of that river as follows: The Save, 375 miles; a second arm of the Danube at its delta, 219; the Theiss, 109; the Drave, 94; besides 188 miles of canals and 51 of short river courses; altogether, 2,491 miles. Its fleet consists of 48 passenger steamers, 97 tugs, 11 propellers, with an aggregate of 62,320 horsepower, together with 802 iron barges, and its vessels touch at 169 landings.

The gross earnings per mile of the Austrian railroads in 1901 were 2 per cent. less than in 1900, which, considering the bitter complaints of bad business, seems very little. An extraordinarily large crop of sugar beets offset to some extent the decreased business in general manufactures. The discussion provoked by the proposal to abolish export bounties on sugar throughout Europe has led to the publication of some statistics of the traffic which the beet-sugar industry supplies. In 1900 (less productive than last year), six of the principal Austrian railroads carried 1,409,400 tons of coal, of beets and beet pomace (the beets from the farms to the sugar mills and the pomace from the mills back to the farms, for feed), and 1,859,736 tons of raw and refined sugar. The beets are usually hauled but a few miles; but a considerable part of the sugar goes the longest distance possible in Austria, to Trieste, for export, chiefly to the East Indies. The decrease in Austrian railroad earnings in December was $4\frac{1}{4}$ per cent. The decrease in the receipts of the Hungarian railroads for the whole year was less than 1 per cent.; for December, 2.4 per cent.

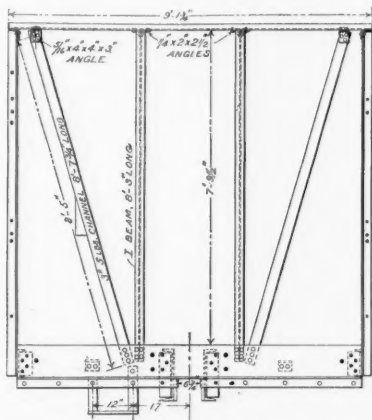


Standard Body Bolster for 80,000 lbs. Capacity Car.

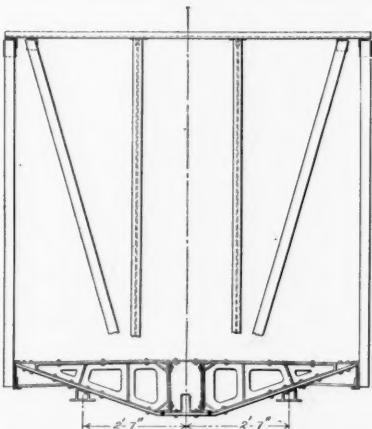
riveted to an angle which is also riveted to the side plate. The manner of attachment of the end members of the frame is clearly shown in the frame drawing. The reason that field rivets are shown for a number of the connections is that the riveting shop does not completely erect the frames, but ships the sides, bottom and end frames separately, to be finally connected up at the car erecting shop.

There are some obvious difficulties in the way of using a steel framing for box cars that do not exist in the case of gondola or hopper cars. In the latter it is quite possible to use metal throughout, but in the case of the box car it is evident that a considerable quantity of wood must be used for nailing strips, the floor, the lining and the sheathing. In this case the car is lined up to the second belt rail at the side and all of the way up to the plates at the ends. The belt rails are cut in between the posts, but are made practically continuous along both the sides and ends.

The ends of the car are strengthened in accordance with the practice that has been followed for some time on the Norfolk & Western in box and stock cars, by the use of I-beams, as shown in the end elevations. The value of this method of stiffening has been thoroughly demonstrated in service and the necessity for the use of a stronger construction than existed in older cars is appreciated since the introduction of the M. C. B. coupler has developed a severer switching service on all cars so equipped. The I-beam end post has thus shown itself to be an important element in the stiffening of the ends of box and stock cars.



End Elevation of Steel Framing for Box Cars.



Body Bolster Connection to Steel Framing of Box Car.



ESTABLISHED IN APRIL, 1856.
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EDITORIAL ANNOUNCEMENTS.

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The gross earnings of the railroads for March showed an increase of 6.3 per cent., as compared with the year before, in spite of some pretty hard conditions. The freshets were very extended and severe, and the grain movement in the West and the cotton movement in the South were considerably less than a year ago. In spite of these adverse conditions only a few roads fell below last year's figures, and in few cases was the decrease important.

We wrote recently (April 4) of the fact that the Pennsylvania Railroad Company is going to use the high-speed brake on all of its passenger equipment on all lines, East and West of Pittsburgh. We learn now that the Lehigh Valley Railroad and Grand Trunk Railway have decided to use the high-speed brake for all passenger stock. The Lehigh Valley has already received equipment for a good many cars, and some of the local papers say that by June 1 every passenger car in the service will be fitted. Officers of the company do not promise this, but do say that the equipment will go on as fast as is convenient until all passenger rolling stock has the high-speed brake. Naturally this is peculiarly gratifying to us, not only because of our steady efforts to advance good railroading, but because it is a further endorsement of the judgment that we have repeatedly expressed that the economy and efficiency of the high-speed brake is by no means limited to a few very fast express trains.

In another article on this page we have touched upon some of the general questions connected with the proposed change in car-service compensation; but there is one question of detail on which it may be well to say a word, for the reason that it is one which may get buried out of sight by the multitude of other details thought to be more important. One road asks if it will be practicable to collect a dollar a day from consignees while the charge between railroad companies is only 30, 40 or 50 cents a day. As the bill against the consignee may rightfully include a profit (while the interchange rate must approximate to the cost), and as the consignee's bill is largely for rent of track, it would seem as though this question ought to be quickly answered in the affirmative; but, the question being debatable, why not consider the advantages of an adjustable demurrage rate? In the establishment of demurrage bureaus fifteen years ago a rigid rate was looked upon as a necessity, owing to the difficulty of collecting anything at all. But a good many of the uncertainties of that time are now done away with, and it will be practicable, with per diem rates for interchange, to take more rational action. When cars are scarce there is no good reason, except the danger

of little "wars" between the railroads themselves, why consignees should not pay a dollar, or even, in many cases, two dollars, for 24 hours' storage, in a car, of 10 to 20 tons of freight; and 40 tons ought to pay twice as much as 20. If the railroad is paying out, for that car, only a tenth of what the consignee pays, the difference is not only justifiable, by the fact that this road is also lending (to the other) at the same rate, but it is also easily explainable to the consignee. The duty of collecting adequate demurrage when cars are very valuable is not, however, a whit more important than the duty of keeping the rate reasonably low when cars are not scarce. Demurrage must be collected all the year round, if for no other reason than to keep the clerical force constantly in the harness and to enforce a tolerable degree of equity as between different consignees; but in dull times it is pretty nearly true to say that the charge is required only for the purpose (1) of paying for the use of the ground and (2) for preventing abuses. These two purposes can be fulfilled by, let us say, a charge of 50 cents a day for the first few days beyond the free time, and a higher rate afterwards. This being so, why charge a higher rate, with its accompanying temptations to your competitor to take the occasion to get the better of you, and the inevitable friction in collecting the bills? The most expert car service men have declared the more general collection of demurrage to be an essential element in the success of a per diem interchange rate. It is to be hoped that they will vigorously preach their doctrine and compel everybody to appreciate it. Why should not the members of every demurrage association meet and establish a new rate every month?

A Brooklyn Bridge Episode.

We regret to see in the *Brooklyn Eagle* of the 15th the following letter from Mr. Lindenthal, the Commissioner of Bridges:

Some time ago I had received a well meaning but unnecessary warning, that a certain aggrieved firm of Tammany contractors were conspiring with some disaffected underlings in my department, to attack me through the newspapers for purposes of their own, and which are not hard to guess.

It is true, and nothing new, that among many patents on various inventions I happen to have some relating to wire links. It is not a fact, however, that I had asked for a change of plans in bridges Nos. 3 and 4 over the East River so that they may be used in them. Any assertion to the contrary is a lie, as stupid as it is malicious.

I found much room for improvement in the plans for those bridges on the score of greater economy, better aesthetic appearance and for making them fireproof. The plans for Blackwell's Island Bridge provided no access to the Island, etc., etc. The plans showed immaturity throughout and had never been examined or passed upon by expert engineers.

It is, perhaps, not known to the general public that the cables of Bridge No. 2 (the plans of which were never scrutinized by experts before construction began) cost the city 14 cents per pound, while the cables of the Brooklyn Bridge, twenty years ago, when steel was nearly twice as costly, cost only 10 cents per pound, finished in place. That is, after twenty years of progress, when every other form of steel product has cheapened, the city is paying 40 per cent. more for its cables, and at a time when steel wire cables for some recent Western suspension bridges were erected for less than 8 cents per pound.

Another experience in Bridge No. 2 was furnished, when the specifications for a large amount of steel were needlessly so drawn that only one steel works in the country could furnish it, at prices about 50 per cent. higher than the best structural steel in first-class railroad bridges elsewhere. The extra cost on those items alone represents in the aggregate over \$500,000 taken out of the city treasury for whimsical engineering, to say the least.

We are compelled to believe that this letter was written in haste and under extreme exasperation. It cannot harm the respected and even eminent gentlemen whose work it criticizes. They have passed far beyond any danger from such statements. But it can and will greatly harm the Commissioner, and for that reason we regret that he ever wrote it. His personal fortunes are tied up with the reform government of New York, and he cannot injure himself now without injuring that government.

It is hardly worth while to say anything here about the specific charges which the Commissioner makes against his engineers or about his hints of corrupt or incompetent management of their affairs. If we were writing for a daily newspaper we should consider it important to take those things up in detail, but our readers know the folly of the points raised. It is said, for instance, that the plans for Blackwell's Island's bridge showed immaturity throughout and had never been examined or passed on by expert engineers. The Chief Engineer of that bridge who made the plans, is himself something of an expert. His short life has not been passed in making plans that have never been built. On the contrary, he was the responsible engineer in charge in the building of two of the greatest steel arches in the world, namely, those over the gorge at Niagara. He was chief engineer of the Lewiston & Queenston suspension bridge over the Niagara River. He has done considerable responsible consulting bridge work besides this, and has just been appointed chief engineer of a pretty important bridge building company.

Another of the statements in the Commissioner's letter is concerning the increased cost of wire in

Bridge Number 2, as compared with the old Brooklyn Bridge, namely, 40 per cent., notwithstanding the decline in the price of steel. This statement is incomplete and misleading. The wire in the old bridge has an ultimate strength of 160,000 pounds; the wire for Bridge Number 2 has an ultimate strength of from 200,000 to 230,000 pounds. Only one company bid for the contract for the wire for Bridge Number 2; others having been kept from bidding by conditions imposed by law, with which the Chief Engineer had nothing to do. The Commissioner is pretty near the truth in saying that the wire of the old bridge cost 10 cents a pound. The galvanized wire, delivered on the ground, cost between 9 and 10 cents. After that it had to be cleaned, oiled and rewound, threaded and made up into cables. It was delivered in 800-ft. lengths; the new wire is delivered in 3,500-ft. lengths. Colonel Roebling has recently said that in the cables the old wire cost 16 cents. Mr. Martia lately said in conversation that he had an impression that the wire in the cables cost close to 20 cents. He had not looked at the records lately. The new cables, in position, complete, ready to go to work, will cost 14½ cen's. In brief, the wire of the new bridge has 34 per cent. greater tensile strength, is more than four times as long between splices and costs less in place than the wire of the old bridge.

The statement that the steel specifications were so drawn that only one steel works in the country could furnish it is equally misleading. Our readers will remember well the discussion which went on at the time, concerning Mr. Buck's requirement of acid open-hearth steel. The reasons why he wanted it are apparent to every engineer, and there was no reason why any of the great steel companies should not have bid on the acid steel if they wanted to. Unquestionably, many of these companies would have bid who did not bid had the contracts been let a year or two earlier; but they came into the market at a time when nobody was worrying much about the sale of his steel product. As we stated at the outset, it is not worth while to explain these matters to our readers. The two Bucks need no apology or defense.

Can Car-Service Be Reformed Without Per Diem?

We think that we are right in saying, as we did say last week, that the principal railroads of the country have the power to compel the general adoption of a new and better basis of compensation for the use of borrowed freight cars, even against considerable opposition. And having the power, coupled with the belief that a new basis is urgently needed everywhere, there is a duty to exercise the power. But it is equally true that no universal rule, to which many companies must submit whether they like it or not, can be expected to work satisfactorily unless it is based on equity and fairness. It is of the highest importance, therefore, that the claims of those roads, like the Chicago & North Western, and the New York, New Haven & Hartford, which foresee a certain loss in their car-service accounts, shall be dealt with on sound general principles, so that they shall be settled on a just basis. They cannot rightly be considered on the basis of any temporizing or local scheme that aims merely to cure a single specific difficulty, at one or a few places, with no regard to the causes which have produced it.

When the discussion begins, the first and worst objections will, no doubt, come up in the shape of apparently unanswerable claims of inability to adopt a per diem rate in certain places where at present the use of cars is given, free, for long periods, to customers who receive large quantities of freight. Questions of this kind—which, it is to be admitted, are not likely to be finally settled until after many arbitrations—are so hard that they might easily be allowed to take up whole days of time in the convention, without the accomplishment of any appreciable good. But this is an outcome which must be avoided, and it is gratifying to know that the men who are most likely to dwell on the difficulties of this character have themselves suggested a course by which it can be avoided. They have themselves laid down a proposition, on the basis of which the whole subject can be discussed from the standpoint of general principles, the only true basis on which it can be discussed with much prospect of making real progress. This proposition is that reform depends:—

First, upon railroad companies providing sufficient locomotives, cars and terminals to handle their business properly.

Second, that the public shall equip themselves with facilities that are equally liberal and modern.

Third, the adoption of universal car service [demurrage] regulations which shall embrace railroad free warehouse storage as well as car detention.

Fourth, capable and conscientious management.

Now, how can all these very desirable measures be accomplished? Everybody admits that they are desirable; but when one comes to consider how best to put such excellent ideas into effect he stands perplexed if not discouraged before the great difficulties in the way. Take, for example, the second requirement. How will you get a retail coal merchant to build a new bin under the track to enable him to unload 50 tons of coal quicker than he formerly unloaded one ton? There is only one way; he must be made to suffer loss until he does do it. He must be made to pay demurrage on the cars which he uses as storehouses, as long as he neglects to provide a suitable storehouse of his own. The first and third requirements may be looked upon in exactly the same light as the second, for you must deal with a railroad, even your own railroad, on precisely the same principle that you deal with the coal dealer. A railroad is such a large and complicated machine that it is just as much a necessity to thus take indirect measures to accomplish specific objects, as it is to regulate a man's liver in order to clear his brain.

In regard to the first requirement, it may be said that all enterprising railroads nowadays keep constantly in mind the aim "to provide sufficient locomotives, cars and terminals;" but they accomplish their aim with varying degrees of success and promptness; some of them with but little success. To adopt per diem car service rates a start must be made everywhere on a given day; and the only way to overcome the obstacle of the varied conditions on a thousand different railroads is to put a penalty on those roads which lack the facilities. This will force such roads to provide them. Any other means than such direct financial pressure would be inequitable. It seems harsh, but it is necessary. Of all the irrational ways of looking at the car-service problem, none is more irrational than that based on the notion that each road must see that its car service expense is no larger than it has been under the mileage method.

Furthermore, there will be inequalities even after all roads have done their best. The mileage plan would be wrong if every road had unlimited locomotives, cars and terminals. We shall always have cases where the consignee's interest will lead him to delay unloading; demurrage is the only means of administering justice in such cases, and per diem between roads is essential to the maintenance of demurrage collections.

It seems to us that free storage in freight houses will be likely to take care of itself. Not many roads are ever going to charge for such storage as long as borrowed cars, costing nothing, can be used as annexes to the freight house (for not many appear to realize that the ground on which the cars stand is a large element in the cost of the storage); and it would seem equally certain that most roads will voluntarily charge for house-storage (or build additional houses) as soon as, by reason of the high cost of car-storage, they find their freight houses overcrowded.

Capable and conscientious management goes without saying, whatever the phase of railroad affairs under discussion. For purposes of argument we must assume that kind of management; it is a "working hypothesis."

Two Collisions on the North Eastern.

The British Board of Trade has issued reports on two collisions where, as in other English cases recently reported in the *Railroad Gazette*, some of the unsatisfactory features of audible signaling, as practised in England, are entertainingly illustrated. These collisions occurred on the North Eastern, Nov. 24 and Dec. 21 last, and both were caused by engineers running by signals at danger.

In the first collision, at Castleford, a train was crossing from the down to the up line when it was run into by a down special passenger train. The signal tower immediately in the rear of Castleford is known as "Castleford Gates," and the towerman there kept his signals at danger for the special train, as it had not been "accepted" by the man at Castleford station. As there was a slight fog at the time the man at Castleford Gates, by means of a machine worked from the tower, put a torpedo on the rail at the distant signal, which the engineer admits he heard explode, and he shut off steam and applied his brakes. But he approached the home signal at such a speed that the towerman, seeing the train would not stop, ran down and put two torpedoes on the rail. The engineer states that he was traveling at the Gates tower about 25 miles an hour; he admits that with that speed he could not have brought his train to a stand at the home signal, if he had found it against him, and this, he says, was due to the fact of there not having been sufficient brake power on the train.

He also says he saw a green light, which he took to be the [all-right] distant signal for Castleford station, and he consequently concluded that the home signal for Gates, which was above this, must be off also. He denies that any detonator went off under his engine when passing the Gates tower or that the towerman showed him a red light; he accordingly released his brakes and ran on to Castleford station.

When approaching Castleford station the engineer admits that he could not see the station home signal, but having, as he thought, seen the distant signal off, he concluded that the home signal must be off also, and he accordingly ran through the station at 25 miles an hour. The fog at this time was so dense at the point where the collision occurred that he never saw the train with which he collided; he felt his engine checked, so he at once took steps to bring it to a stand. He then discovered that the front wheels of the engine were derailed, and he subsequently ascertained that it had been in collision with the other train.

There can be no doubt that the signals both at the Castleford Gates and at the station were at danger when the train passed them and the engineer does not seriously dispute this fact. Considering that, as he himself admits, a torpedo exploded when he passed the Gates distant signal, showing him that that signal was at danger, it was incumbent on him to have had his train well in hand ready to stop at the home signal. His excuse, that he had not sufficient brake power, will not hold water, for the distance between the distant and the home signal is 2,200 ft., and though the brake power on his train was not as great as it should have been, it was ample to have brought his train to a stand in that distance.

Again, even according to his own account, the view which he got of the Gates home signal was a very uncertain one and his fireman was unable to see it at all. Under those circumstances he acted very recklessly in running on without ascertaining whether it was off for him. The same remark applies to his passing the home signal at the station, which he admits he did not see at all.

Both the engineer and fireman dispute the fact of any torpedoes having exploded under their train at Gates tower, but the towerman's evidence on this point is corroborated by that of the station master at Castleford, who asserts that just before the special train arrived he distinctly heard two torpedoes explode. This man was booked to work 11h. 39 min., which the inspector deems longer than an engineer should be called upon to work.

The other collision occurred at Neville Hill, Leeds, when a train from York was run into by one from Bridlington and the conductor of the York train was killed.

The tower in the rear of Neville Hill is Waterloo Junction, and there the towerman, when the Bridlington train approached, kept his signals at danger, as the York train was in the section and standing at Neville Hill home signal. The man at Waterloo Junction then lowered his outer home and direction signals for the Bridlington train to draw up to the inner home; but the engineer, instead of stopping there, passed the signal at danger and went right ahead and subsequently came into collision with the York train. There was a fog at the time, but the towerman says he could see the inner home signal from the tower, 230 ft. away, and a man who was standing still farther away states that he also could see the signal. The engineer admits that he did not see this signal, and his explanation of running past it is that he was under the impression, which he candidly admits to be a wrong one, that on account of the outer and direction signals being lowered, the section ahead was clear for him. He asserts that on account of the fog he could not see the inner home signal and he maintains that the fog was so thick that the towerman should have put down torpedoes if he had wished to stop him at the inner home signal. But the inspecting officer thinks that if the engineer had been keeping a careful look-out he could have seen that the inner home signal was against him. If he was unable to see it he should certainly have treated it as a danger signal.

Thus we have one case where torpedoes were used but the engineer thought that he could just as well get along without them, and another where they were not used but where, in consequence of the common practice of using audible signals, the engineer tried to shield himself against censure for neglect of visual signals by blaming the signalman for not using torpedoes. One obvious comment is that locomotive runners seem to be a good deal alike, all the way from North Eastern England to South Western Mexico. Some people will look upon cases like these, showing, as they do, many characteristics exactly like those brought out in similar investigations here, as only furnishing additional evidence, which nobody needs, that the personal equation is an unmeasurable factor which we can never get rid of and which, therefore, is a part of our fate. We can never make engineers perfect, hence we may as well stop striving after perfection. Whatever one may say as to that, these lucid reports of the English inspectors are, we think, excellent instrumentalities for providing the publicity which is now recognized as one of the best elements in Governmental regulation of railroads, and their beneficial effect may be greater than appears on the surface. Certainly they give to all railroad officers, in a most admirable manner, the lessons of more accidents and more kinds of accidents than any one officer can investigate for himself, so that if any one does want to train his men to a better standard he need not lack for the instruction necessary to make a beginning.

NEW PUBLICATIONS.

The Railway Year Book for 1902. Compiled and edited by G. A. Sekon. London: The Railway Publishing Company, 30 Fetter Lane, Fleet street. One shilling. This small handbook to the railroads of the United Kingdom is now in its fifth year and each year it becomes more the Whitaker of the railroad world. Its information is varied and is on the whole accurate, though there are some trifling points which no doubt by another year will be corrected. The contents begin by a list of the principal events in English railroad history. After that are the various commissions and the new bills deposited by the companies. Information is given regarding the amount of single, double, treble and fourth track of the respective lines. The principal towns and the fastest trains are given as well as the fastest start to stop runs booked in the country. There is also a list of the companies using the vacuum and the Westinghouse brakes. In the short notice of each company appear its history, the names of directors and officers, and the chief points of the line physically, with a clear map of every system. There are also tables giving the ratio of expenses to earnings and the loading gages of every line. The book ends with a railroad "Who's Who," which, though incomplete, is of value and will no doubt be improved each year.

Directory of Directors in the City of New York.—Published by the Audit Company of New York, 994 pages. The Winthrop Press, New York, 1902. \$3.00.

The Audit Co. of New York issued recently the fourth annual edition of its *Directory of Directors* which appears in form similar to previous editions except that it is slightly enlarged. It is designed also to follow the list of officers and directors in important railroads and industrial corporations in the Appendix by the names of the subsidiary companies controlled by these corporations. This publication has taken its place among useful books of reference, since it affords, in the first place, an hint of individual credit. The importance of the companies which follow the names in the *Directory* give, particularly to men who are engaged in corporation or professional business, a standing which the ordinary mercantile agency books, showing as they do only ratings of merchants and manufacturers, do not give. The book also contains an excellent list of names for purposes of selling and advertising, and is more convenient than the cumbersome city directory. It contains 18,000 names.

TRADE CATALOGUES.

Dump Cars.—The Goodwin Car Company, New York and Chicago, is sending out a 40-page catalogue containing some line-drawings, diagrams, and many half-tone illustrations of its steel dump cars. There are unloading operations illustrated covering a wide range of ballasting and dock work. The catalogue will be of value to engineers and contractors who are concerned with maintaining or laying track, and, likewise, to those responsible for rolling stock. The illustrations are all of big work done cheaply, in a big way. From the cover of the catalogue it is apparent that this will be one of the Goodwin Car Company's souvenirs of the coming June conventions at Saratoga: the first trade note of the conventions that has reached us in the way of "souvenirs."

Paint.—The Protectus Company, Philadelphia, Pa., has just issued a catalogue of 31 pages telling of the various uses to which Protectus paint has been successfully applied, and illustrating important structures, vessels and machinery that have been protected by its use. There are a few pages of discussion of paint as a protection for steel and other materials, and there are some remarkable records of good work in the pages that follow. Car, locomotive, power-plant, bridge, marine and house-building work all receives attention, and we take pleasure in bringing the catalogue to the notice of motive power men, car builders, bridge engineers and others of our readers.

Fishing on the Picturesque Erie. By D. W. Cooke, General Passenger Agent.—In making this octavo pamphlet of 80 pages Mr. Cooke has been moved by a serious purpose; the giving of real information and the encouragement of summer travelers to have an object in view and study and learn something during their outing trips. There are chapters on the game fishes: Brook trout, large-mouth and small-mouth black bass, pickerel, yellow perch, pike perch and muskallonge, and in each of them there is a happily-arranged, condensed scientific description of the fish and of the fair and manly ways of catching them. It is well done and stops soon enough to charm the reader to further fish studies in the streams and lakes on the Erie road, which are finely pictured in the pamphlet. The stations, which are setting-out places for fishermen, are completely catalogued with all the information needed. It is a good fishing directory, and it is followed by a synopsis of the fishing laws of New York, New Jersey and Pennsylvania. An excellent map accompanies this creditable and attractive publication.

Inspection Cars.—The Light Inspection Car Co., Hagerstown, Ind., has sent out its eighth annual catalogue giving full information about track inspection cars which it makes.

The Rapid Transit Subway in New York.

The Citizens' Committee of Safety not long ago appointed engineers to examine the condition of the Rapid Transit subway in New York, in connection with the engineers of the Rapid Transit commissioners and contractors. The engineers for the committee are: Virgil G. Boghe and Albert C. Webster. The engineers for the commissioners are William Barclay Parsons and George S. Rice (Chief Engineer and Principal Assistant Engineer of the Commission), and Theodore Cooper, Consulting Engineer. The recommendations of the engineers were made public on Wednesday of this week, as follows:

West Tunnel.

In our opinion work can safely be resumed in the west tunnel under Park avenue by beginning the blasting only at the north and south end of the unfinished portions of the roof lying between Thirty-seventh and Fortieth streets. Moderate charges to be used throughout, especially moderate at the north end for the first 50 ft., and as long as and whenever there is any indication of defective rock. The Rapid Transit Commission to make in advance of the excavation diamond drill borings from the surface to within at least six feet of the neat line of the tunnel, provided the rock is sound, or deeper, if necessary, to show how much solid rock there is above the neat line of the tunnel. Holes to be placed about 75 feet apart and as near as practicable following the center line of the tunnel. The masonry lining and arching to be kept as close as possible to the face of each excavation.

East Tunnel.

No blasting to be done between station 164 plus 50 near Thirty-seventh street and station 170 about 40 ft. north of Thirty-ninth street, until the arching is completed up to the bench at the north end. At least one diamond drill hole to be driven north of Thirty-eighth street on the east side from the surface outside of the neat line of the tunnel, and in addition 10 test drill holes to be driven on each side from the top of the bench, between stations 168 and 170, diagonally outward to the subgrade, to determine the character of the rock.

Before the work is allowed to proceed, if there are indications of bad rock, extra holes are to be put in to determine the quality of the rock. If these investigations indicate sufficient rock of suitable quality the work of removing the same south to the center line of Thirty-eighth street may proceed under the conditions and with the same precautions as indicated for the west tunnel; the whole of the section of the east tunnel from which the roof has not yet been removed to be thoroughly timbered and braced during the progress of the work. Further consideration of the section between stations 164 plus 50 and the center line of Thirty-eighth street shall be postponed until the investigations as to the character of the rock shall be completed.

TECHNICAL.

Manufacturing and Business.

Conrad H. Matthiessen has been elected to the Board of Directors of the Chicago Pneumatic Tool Company. Edward N. Hurley and Sir Arthur Macdonald, of London, have also been elected to the Board.

The S. A. Woods Machine Co., South Boston, Mass., is building for the new shops of the New York, New Haven & Hartford, at Readville, Mass., now nearly finished, a large number of its car machines, some of which are from special designs.

The Wells Light Manufacturing Co. of New York reports its sales for the month of March, 1902, to be more than double those of any other two corresponding months put together; for April to date, 14th, the sales are equal to a full month's business.

G. S. Wood & Co. was recently formed to deal in railroad supplies, and has opened offices and sales rooms at 100 Lake street, Chicago. The company consists of Guilford S. Wood, Harry H. Schroyer and Stanley Woodworth. Among the specialties to be handled are upholstery supplies and leather goods for railroad work.

The McKiernan Drill Co., New York City, has just secured from the New Jersey Zinc Co., of this city, for its zinc mines at Franklin Junction, N. J., an order for two Cross compound condensing Corliss air compressors, each with a capacity of 6,534 cu. ft. of free air a minute. The price paid for these compressors was \$50,000.

The H. W. Johns-Manville Co., New York City, has secured, through its St. Louis branch, a contract for pipe covering in the new Bank of Commerce building, St. Louis. The material to be used on the main pipes and risers is Asbestos-Sponge molded covering, and the branchings and hot water tank will be covered with Johns' magnesia.

The Industrial Water Company informs us that after April 15, 1902, its New York office will be at 126 Liberty street, with more commodious quarters to meet the requirements of an expanding business. The company is prepared to make propositions to steam users in any part of the world for the softening and purification of hard water, and for the removal of oil from condensed engine steam.

R. B. Corbett announces that he has acquired the domestic machinery department of Frank Bros., and has consolidated it with the A. G. Shoemaker Co., of 126 Liberty street, New York. The contemplated extensions and improvements of Frank Bros., including a factory and yards at Newark, N. J., will be carried out by Mr. Corbett. The new concern will deal in electrical machinery,

cars, motors, engines, boilers, relaying rails and new and second-hand machinery, and will make a specialty of machinery repairing work.

Joseph D. Gallagher, formerly President of the Lappin Brake Shoe Co., has been appointed Second Vice-President, and Joseph B. Terbell, formerly President of the Corning Brake Shoe Co., has been appointed General Sales Manager of the American Brake Shoe & Foundry company. Other appointments are: Elmer J. Snow, General Superintendent; F. W. Sargent, Chief Engineer; J. S. Thompson, Assistant Chief Engineer; H. Jones, Mechanical Engineer. After May 1 the headquarters will be in the Maiden Lane Building, New York.

An article of interest to architects and builders is "Keystone" hair insulator for insulating buildings against extreme temperatures, and for sound deadening. In a paper on insulation of cold storage presented at the October Convention of American Warehousemen, at Buffalo, Mr. John E. Starr demonstrated the "Keystone" to be from 20 to 40 per cent. superior to other materials commonly employed. The exclusive selling right for "Keystone" hair insulator, patented and manufactured by Messrs. Julius De Long & Co., of Allegheny, Pa., has been secured by the H. W. Johns-Manville Co., who are carrying stocks in various parts of the country.

The O. M. Edwards Co., Syracuse, N. Y., maker of the Edwards window fixtures and vestibule trap door and other railroad supplies, is building a four-story structure, 83 ft. x 30 ft., to be used as a factory and office. The machinery room and stock room will be on the first floor; and the office, drawing room and model room on the second floor; the third floor has been divided into pattern, tinning, lacquer and coppering rooms. The factory will be run by electric power, and it is expected will be working to full capacity within the next four weeks. All the plans and drawings for the building were made by the company.

The Lima Steel Casting Co., of Lima, Ohio, whose plant was considerably damaged by fire on Feb. 23rd, has consolidated with the National Steel Casting Co., of Montpelier, Ind. The plant at Lima will not be rebuilt now. All the machinery and equipment of flasks will be transferred to the Montpelier plant. D. E. Harlan, Manager of the Lima plant, goes to Montpelier as Treasurer and General Manager of the consolidated company, with headquarters at Montpelier, Ind. The officers of the new organization are: G. Max Hofmann, Ft. Wayne, Ind., President; James O'Donnell, Vice-President; F. E. W. Scheimann, Secretary, and D. E. Harlan, Treasurer and General Manager. With the addition of the equipment from the Lima plant, this consolidation will make the Montpelier plant one of the best equipped steel plants in the country.

Iron and Steel.

It is reported that the Groton bridge works of the American Bridge Co. has been sold and will be put in operation again.

About 800 tons of old iron and steel rails are offered for sale by the United Railways of the Havana & Regla Warehouses Ltd., as stated in our advertising columns.

The report of last Sunday that a new steel company was being formed, with a capital of \$200,000,000, is denied by pretty nearly all the companies who were said to be interested.

The National Bridge Company, of Indianapolis, has incorporated. The capital stock is \$20,000, and the directors are Daniel B. Luten, G. H. Marsteller and E. H. Luten, all of Lafayette, Ind.

The time of the original underwriting syndicate of the United States Steel Corporation expires by limitation on July 1. It is said, however, that for the purposes of the bond issue, the time of the syndicate will be extended.

Of the various reports about the demand for rails, one is that it will be necessary to import a larger amount than has already been recorded, to satisfy the demands of the railroads. It is said that practically all mills are booked for the entire year, and in addition to this, it will be found that more business will be carried from this year's books into 1903, than was carried from last year into 1902. There seems to be no present intention on the part of the rail pool to advance prices from the prevailing schedule, the present minimum being \$28 a ton.

Reuben Miller, Chairman of the Crucible Steel Co. of America, has announced that he will retire on May 1, on account of ill health. It is said that the Chairmanship will not be filled for some time. Mr. Miller was President of the Crescent Steel Co., and was one of the principal men in the formation of the Crucible Steel Co. He was at first chosen Treasurer, and upon the retirement of Wm. G. Park as Chairman of the Executive Committee, he added the duties of that office to those of Treasurer. Mr. Miller is also interested in the St. Clair Furnace Co., and the St. Clair Steel Co., allied corporations to furnish raw material. Julius Bieler, President of the Third National Bank, Pittsburgh, who has been Assistant Treasurer, will succeed Mr. Miller as Treasurer.

Heavier British Locomotives.

In the second of a series of articles being written for *The Engineer* (London) by Mr. Rous-Marten, he gives in the issue of March 21 a summary of the more recent advances in locomotive building in England. The work of Mr. J. A. F. Aspinall, of the Lancashire & Yorkshire, Mr. J. F. McIntosh's work on the Caledonian Ry., especially the design of the Dunlaster type of locomotive, some of Mr. F. W. Worsdell's designing of single-driver

compound engines, and the work of Mr. Wilson Worsdell in designing the six-coupled locomotives for the North Eastern, are considered. Mr. Rous-Marten's review of these designs culminates in some information about a new express locomotive recently built at Swindon, and conforming to designs by Mr. W. Dean, Chief Supt. of the Locomotive Department of the Great Western. Mr. Dean's locomotive is said to be the biggest and heaviest thus far used on British railroads. The road number is 100. The boiler has a Belpaire fire-box, 9 ft. long, and the boiler, complete, is 14 ft. 8 in. long and 60 in. in diameter. There are 2,400 sq. ft. of heating surface and the working steam pressure is 200 lbs. per sq. in. It is a six-coupled locomotive with driving wheels 80½ in. in diameter and the cylinders are outside of the frames, 18 x 30 in. The weight of the engine in working order is 69 tons, which is about two tons more than the weight of the heavy six-coupled locomotives on the North Eastern, and more than 10 tons heavier than the heavy Lancashire and Yorkshire locomotives of the 1,400 class. The weight on driving wheels is about 50 tons. The tractive force will be 121.5 lbs. per pound of mean effective pressure.

The Hall Electro-Gas Semaphore.

The Delaware, Lackawanna & Western has ordered from the Hall Signal Company 50 of the Hall electro-gas automatic semaphore signals. This order has been placed after a long test made by the railroad company with one of these signals on the Pocono Mountain, Pa., where it endured severe winter weather. It was later taken to Hoboken and further experimented on. This signal is operated by means of carbonic liquid gas which is stored in portable tanks weighing about 150 lbs., and charged to a pressure of about 600 lbs. per sq. in. By means of a regulator or reducing valve this pressure is reduced to about 35 lbs. for the operation of the signal. From the experiments thus far made it is believed that the cost of operating this signal will be considerably below that of any other automatic semaphore signal. The makers say that a 50-lb. tank of liquid gas, costing six cents a pound, will operate an ordinary semaphore blade an average of 12,500 times, or at the rate of something over 200 blade movements per pound. If bought in larger quantities this material can be had for about 4½ cents per lb., which will further reduce the cost. Assuming that an ordinary electric-motor signal, operated by primary or potash battery costs 75 cents per thousand blade movements, the gas signal will cost only about one-third as much, as it can be operated for not over 25 cents per thousand blade movements. The cost of labor for maintenance is also much reduced, as it is a very short job to put in a new tank, while to set up 16 cells of potash battery takes a man about half a day. Again, on account of the simplicity of the gas mechanism, three maintainers can probably look after as many signals as five could with the motor signals. These estimates are based on close observation.

One of these signals has also been in service for some months on the Lehigh Valley near Sayre, where it has operated in regular service without any failures. Another one is in service on the Putnam division of the New York Central, where it has given excellent service. A third is in operation on the Illinois Central near Sixty-seventh street, Chicago, where it is used as a distant signal in connection with an interlocking plant. This signal has also worked perfectly since it was installed some months ago. The Hall Company has received a number of other orders for this signal from various roads, among them being the Baltimore & Ohio, the Cincinnati, N. O. & T. P., the Southern Pacific and the Pennsylvania.

Interlocking.

At Fostoria, O., it is reported that interlocking signals are to be put up at the junction of the Baltimore & Ohio, the Ohio Central, the New York, Chicago & St. Louis and the Hocking Valley roads. It is said that the all-electric apparatus will be used.

Falls Hollow Staybolts.

The Engineering Department of McGill University, Montreal, Que., recently made a test for the Falls Hollow Staybolt Co., Cuyahoga Falls, Ohio, of a piece of the iron from which its hollow staybolts are made with the following results: Ultimate strength, 49,300 lbs.; yield point, 32,000 lbs.; elongation, 31.2 per cent.; reduction of area, 45.7 per cent. J. W. Shepherd, Assistant in the Department of Chemistry, University of Chicago, is authority for the statement that in a properly drafted locomotive using bituminous coal for fuel, a judicious distribution of hollow staybolts will, by the introduction of air, be economic of fuel and reduce the black smoke.

Control of Underground Railroads in London.

Messrs. Speyer & Co. have given out the following statements: "Speyer Bros., of London, Speyer & Co., of New York and the Old Colony Trust Co., of Boston, have formed a syndicate for £5,000,000 sterling (\$25,000,000) to take the shares of the Underground Electric Railway Co. of London, Ltd., incorporated in London. The objects of the new company are to include the acquisition and working, in whole or in part of the future undertakings controlled by the Metropolitan District Electric Traction Co., Ltd., of London, namely: The Baker Street & Waterloo Railway Co., the Brompton & Piccadilly Circus Railway Co., the Great Northern & Strand Railway Co., the Charing Cross, Euston & Hampstead Railway Co., as well as agreements in connection with electrification of the Metropolitan District Railway and also general powers to carry out other similar works. It is intended that Charles T. Yerkes shall be one of the directors of the

new company and the first chairman of the board of directors. The management of the syndicate will be in the hands of the above named three firms. About one-half of the syndicate has been subscribed for in London, and one-half in New York and Boston."

The Pressed Steel Car Company.

Charles Lindstrom has resigned as Mechanical Engineer of the Chicago & Alton, to become Chief Engineer of the Pressed Steel Car Co.

THE SCRAP HEAP.

Notes.

Western papers report that at Cheyenne, Wyo., 25 drinking places have lately gone out of business because the Union Pacific has stiffened its rule forbidding employees to frequent saloons.

The Manistique, Marquette & Northern has contracted with the American Shipbuilding Co. for two 30-car ferries at a price of about \$1,000,000, to be run on its line between Northport and Manistique.

A building costing \$25,000 is to be put up for the Railroad Y. M. C. A. at Baring Cross, Ark., near Little Rock. The Missouri Pacific gives the ground and \$13,000 in money and Miss Helen Gould gives \$3,500.

The Freight Handlers' Union of Chicago announces that the railroads of that city have voluntarily increased the wages of freight house men from 10 to 20 cents a day, and it is asserted that this affects 8,000 men.

Press despatches state that the Pittsburgh & Lake Erie has made large reductions in local fares, in Ohio, to meet the competition of new electric lines, and that the Pittsburgh & Western will now make similar reductions in order to protect its interests as against the P. & L. E.

The Pension Board of the Delaware, Lackawanna & Western announces that the age of compulsory retirement on that road will be 70 years, instead of 65 years, as was announced a few weeks ago, when the pension plan was first published. The age limits for optional retirement will be 60 and 69 years.

Some of the correspondents report increased activity in the discussion of the proposed amendments, but they say, nevertheless, that there is little prospect that Congress will take any action, and the alleged activity evidently consists in the utterances of Messrs. Bacon and Barry and their adherents.

At Austin, Tex., April 13, the Attorney-General of the State filed suits against the International & Great Northern for the enforcement of penalties, aggregating \$25,000, for violation of the rule of the Railroad Commission requiring cotton to be compressed at certain towns and forbidding the roads to take it to others.

Western papers report that the government has made a contract with the Union Pacific for one year, from June 1, for the transportation of troops, both eastbound and westbound, apparently an exclusive contract, covering all the transportation of the War Department between the termini of this road for the period named. Until the issue of the recent injunctions the roads west of the Missouri River had an agreement concerning this military traffic.

A bill has been presented in Congress to amend the "Safety Appliance Law," by requiring automatic couplers on locomotives, tenders and all vehicles, as well as on freight cars, and also to require the use of the air brakes on every car in a train which is equipped with air-brake apparatus. There have been one or more Committee hearings on the bill, at which the brotherhoods of railroad employees were represented by Mr. H. R. Fuller, and the Southern Pacific, the Pennsylvania and other railroad companies were represented by counsel.

The arrangement devised by Mr. E. L. Granel, of Carthage, N. Y., for connecting a telephone, carried in a car or locomotive, with the telegraph wire along the side of the railroad, is now in use on the Rome, Watertown & Ogdensburg Division of the New York Central, and, we understand, with marked success. Superintendent D. C. Moon informs us that he has his inspection locomotive equipped with a set of instruments, and also that the station telegraph offices are arranged so that telephonic communication, without interfering with the telegraph, is now available on about 100 miles of his lines. A metal rod is used to hook on to the telegraph wire, and this connection can be made in one minute.

The proposition to establish a Railroad Commission in Canada, which has been under discussion for several months, has now been put in the shape of a bill before the Dominion Parliament. It is proposed to have the tribunal composed of three members, an expert in railroad affairs, a business man acquainted with the public view, and a lawyer acquainted with railroad law. Appointments will be made for a term of 10 years, with eligibility to reappointment, as a guarantee that the Commissioners shall be secure in their seats whatever course they deem it in the public interest to take. Decisions of the Commissioners would be final, without the power of any appeal to the Governor-in-Council at Ottawa.

The Supreme Court of Missouri, in a suit against the Wabash Railroad, has decided that, as a matter of law, annoyances due to boys or other lawless persons on the track are not sufficient to justify an engineman in taking his eyes off the line ahead of him. In the case under discussion the engineman was obliged to blow his whistle to warn some young men off the track, and he applied the emergency brakes. The young men stepped off the

track, and the engineman, in his indignation, turned to look at them as he passed; but during this momentary diversion of his attention, a little girl of four years ran across the track and was killed. The claim of the plaintiff was that if the engineman had strictly attended to his duty he could have stopped the train before striking the girl. The lower court decided against the plaintiff, the girl's father, but he appealed, and the supreme court holds as above stated.

Hearings have been held at Washington on the proposed amendments to the Interstate Commerce law by both the House and Senate Committees on Interstate Commerce. Testimony has been given by gentlemen brought to Washington by the efforts of the "Interstate Commerce Law Convention," acting through its secretary, Mr. Frank Barry. Mr. E. P. Bacon, chairman of the Convention, made a long statement before the House Committee in support of the Corliss-Nelson bill. Other speakers who have spoken or will speak are: J. B. Daish, of the National Hay Association; B. A. Eckhart, for the Chicago Board of Trade; Charles England, of Baltimore; Mr. Meads, of the Boston Chamber of Commerce; E. O. Stannard, St. Louis Board of Trade; Charles Kennedy, Buffalo Board of Trade; T. W. Tomlinson and C. W. Baker, for the National Livestock Exchange; J. T. Hoile and C. N. Chadwick, Manufacturers' Association of New York; William R. Corwin, Merchants' Association (New York); R. W. Higbee, J. J. McKelvie, of New York; T. M. Betts, National Association of Lumber Dealers, and Aaron Jones, Grand Master of the National Grange.

Traffic Notes.

Chicago papers state that over 480 notices of reductions in freight rates were filed with the Interstate Commerce Commission by Western roads in the first half of April. This unusually large number gives some idea of the character of rate cutting when it has to be done openly.

The roads between Chicago and New York have announced that on westbound trains they are going to abolish all second-class fares. The first-class rate over the differential lines is \$18, and over the standard lines, \$20. Eastbound from Chicago there will be no change, for the present.

A press despatch from St. Paul, April 16, reported the announcement of the Chicago, Milwaukee & St. Paul road that it would take independent action on export flour rates from Minneapolis to the seaboard. It published through tariffs to Atlantic ports by way of Lake Michigan ports in connection with all boat lines running between Chicago, Milwaukee and Lake Erie ports and all Eastern trunk lines. The tariff continues the 19½ cent rate heretofore in effect by all lines. It expires April 30.

Effects of the Paris Underground Railroad.

The London *Economist* is quoted as saying that the Paris Omnibus Co., which, in 1900, paid a dividend of 6 per cent., will pay no dividend for 1901 as a result of the competition of the underground road, which has now been in operation not quite two years. The company which runs the river steamboats on the Seine is also in difficulties because of the loss of its traffic, and intends to use part of its fleet on the Saone to pay expenses.

The Transportation Club Dinner.

Last week the Transportation Club (New York) held its annual dinner at its rooms in the Manhattan Hotel. There were about 200 members and guests present. Mr. Depew, the President of the club, was toastmaster. The speakers were: Mr. H. H. Vreeland, Mr. H. G. Prout, Captain J. P. Green, Mr. W. B. Parsons, Mr. Gustave Lindenthal, Mr. J. L. Greetsinger, Mr. George H. Daniels and Mr. Hawke.

THE PENNSYLVANIA ON LONG ISLAND.

Captain Green, in his speech, said some very interesting things about the policy of the Pennsylvania in getting into New York and Brooklyn. Among other things he said what we do not remember to have seen stated officially before, namely, that the Pennsylvania R. R. will make a connection with the New York, New Haven & Hartford by way of Port Morris, so as to run passenger trains through to Boston from western and southern points without any interruption of the journey. This we discussed editorially, March 21. He said also in specific terms that the New York Central was offered the opportunity of becoming an equal owner with the Pennsylvania of the Long Island road. This, of course, has been stated before, and more than once, but it is interesting to get it directly by word of mouth from a responsible officer of the Pennsylvania.

Opening of State Canals.

The State Superintendent of Public Works has announced that the Erie, Champlain and Cayuga and Seneca canals will be opened for navigation at 12 o'clock noon on Thursday, April 24. Announcement of the date of the opening of the Oswego and Black River canals will be made at a later date.

Change of Standard Time in New Brunswick.

The Intercolonial Railway has notified the Montreal Board of Trade that on the Eastern Division of that road Atlantic standard time will be adopted. This means, we suppose, the time of the 60th meridian, one hour faster than Eastern standard time. The time of that meridian has always been spoken of in the Official Guide as "Intercolonial" time, though the name has been of little consequence because all of the roads in the Maritime provinces have used Eastern time. Presumably the change will take place when the summer time-tables are adopted; and we understand that the other roads in New Brunswick and Nova Scotia are likely to make the same change.

LOCOMOTIVE BUILDING.

The New York Central order reported last week was incorrect.

The Toledo & Ohio Central is having three engines built at the Baldwin works.

The Cincinnati, Richmond & Muncie is having five engines built at the Baldwin works.

The Chicago, St. Paul, Minneapolis & Omaha is having two locomotives built at the Baldwin works.

The Cincinnati, New Orleans & Texas Pacific is having two engines built at the Schenectady Works of the American Locomotive Co.

The Pennsylvania is having 49 locomotives built at the Baldwin Works, in addition to the 60 reported in our

issue of Jan. 24. This is part of the general order for 1902, previously reported.

The Chicago, Burlington & Quincy has ordered 25 locomotives from the American Locomotive Co. and 25 from the Baldwin Works.

The Pearl River Lumber Co., Brook Haven, Miss., has ordered a 50-ton consolidation engine, rebuilt at the Hicks Locomotive & Car Works.

The Texas & Pacific is having 15 engines built at the Cooke Works of the American Locomotive Co., instead of 10, as reported in our issue of April 4.

CAR BUILDING.

The Mexican Central is having 50 flat cars built at the Mt. Vernon Car Mfg. Co.'s Works.

The Niagara Junction is having two freights built at the Buffalo Works of the American Car & Foundry Co.

The St. Louis, Kansas City & Colorado has ordered 175 coal and 85 flat cars from the American Car & Foundry Co.

The Interoceanic of Mexico is having 60 box and 20 stock cars built at the works of the Mt. Vernon Car Mfg. Co.

The Bellingham Bay & British Columbia has ordered a combination coach, to be rebuilt at the Hicks Locomotive & Car Works.

The Virginia Coal & Iron Co. has bought 10 flat cars, 36 ft. long, of 55,000 lbs. capacity, rebuilt by the Hicks Locomotive & Car Works.

The Southern Pacific has ordered 250 stock cars from the American Car & Foundry Co., instead of 200, as reported in our issue of March 28.

The American Cotton Oil Co. has ordered 100 tank cars from the American Car & Foundry Co., in addition to the 250 reported in our issue of March 7.

The Waterloo & Cedar Falls Rapid Transit, Waterloo, Iowa, has bought 10 flat cars of 40,000 lbs. capacity, rebuilt by the Hicks Locomotive & Car Works.

The American Car & Foundry Co. has orders for 22 logging, nine flat, eight dump and two tank cars for various purposes, and also 28 miscellaneous orders for freight cars of different types.

The Chicago, Burlington & Quincy has ordered 1,000 stock cars, 500 of which will be built at the company's shops at Aurora and 500 by the American Car & Foundry Co.

The International & Great Northern has not ordered tank cars from the Carroll-Porter Boiler & Tank Co., as currently reported, but has placed an order with them for 50 tanks to be used in converting some of its own equipment into tank cars.

BRIDGE BUILDING.

ALBION, ILL.—Contracts will be let April 24, at 10 a.m., for two steel bridges for the county. Ben. L. Mayne, County Clerk. (March 28, p. 233.)

ALGONA, IOWA.—Bids are wanted April 25 by M. P. Weaver, County Auditor, for three steel bridges, 140 ft., 120 ft. and 60 ft., respectively.

ALLEGHENY, PA.—The Ohio Connecting Ry. has an ordinance before the Allegheny Councils asking for a change of line through the city. The company is asked to build a footbridge in connection with its main structure until the city is ready to build a bridge in the immediate neighborhood. The company also has an ordinance before the Councils for rebuilding the viaduct over the Fort Wayne tracks from California avenue to Preble avenue.

ALMA, NEB.—F. W. Stevens, County Clerk, writes that bids are wanted on or before April 28 for some county bridge work.

ARLINGTON, WASH.—Bids are being received until April 22, with plans and specifications, for the bridge over Stillaguamish River. The structure is 910 ft. over all. Wm. Ross, Auditor.

AUSTIN, TEXAS.—An officer of the International & Great Northern writes us that no date has been fixed on which to get bids for the new steel bridge to replace the present light structure over the Colorado River at Austin. He says that the new bridge will be about 1,400 ft. long.

BAY CITY, MICH.—The Clerk of Bay County is advertising for bids for April 26 for some bridge work, but he does not mention the kind of material.

BENTON HARBOR, MICH.—The city is considering giving about \$5,000 toward the proposed \$20,000 viaduct over the railroad tracks at Broad street.

BOSTON, KY.—The county officers are considering two bridges over Rolling Fork near Boston. One bridge will be about 300 ft. long and cost \$11,000, the other to be about 340 ft., and cost approximately \$13,000.

BRAINEED, MINN.—A bill has been introduced in the United States Senate authorizing the Commissioners of Crow Wing County to build a bridge over the Mississippi River between Pine River and Dean Brook, subject to the approval of the Secretary of War.

BRIDGEPORT, CONN.—The New York, New Haven & Hartford has let a contract for all the steel bridges needed in the Bridgeport improvement in connection with track elevation, to the Pennsylvania Steel Co.

BROOKVILLE, IND.—The County Commissioners have rejected bids for the substructure and superstructure of a bridge over Templeton's Creek and will want new bids.

CAMBRIDGE, OHIO.—Bids are wanted May 7 by the County Commissioners for building a steel bridge about 112 ft. long across Wills Creek. Wm. P. Dehart, Clerk of the Board.

CHATTANOOGA, TENN.—A bill is before Congress authorizing the Southern Ry. to build a bridge over Tennessee River in Marion County, Tenn.

COLESVILLE, N. Y.—The bridge over the Susquehanna River at Nineveh will be rebuilt at a cost of about \$22,000. Chas. P. Stevens, Town Clerk.

CORVALLIS, ORE.—The county officers are receiving bids until May 7 for rebuilding the Mary's River bridge at Corvallis. A temporary bridge will be built while the new structure is being erected.

CRAIG, COLO.—The Commissioners of Routt County will want bids about July 1, we are told, for a steel bridge about 325 ft. long. Address R. H. Green.

CROOKSTON, MINN.—May 13 is the date on which bids are wanted for the bridge over Red Lake River at Main street. (March 28, p. 234.)

DES MOINES, IOWA.—The Park Board is considering building a Melan arch across the Des Moines River to Union Park at Thompson's Bend.

EL PASO, TEXAS.—The contract for the new bridge over the Rio Grande at El Paso, for the El Paso & South Western R. R., we are told, has been let to the Phoenix Bridge Co. The total length of the bridge is about 1,635 ft., consisting of five 183-ft. deck spans, supported on concrete piers and viaduct approaches aggregating about 780 ft. The Missouri Bridge & Iron Works will build the substructure.

FALL RIVER, MASS.—According to report, the Massachusetts Legislature has passed a bill authorizing a new bridge over the river at a point which is not yet determined. The limit of cost is placed at \$400,000. The work will be done under the jurisdiction of the County Commissioners.

FREY TOWN, PA.—The Commissioners of Northampton County are about to get bids for two steel bridges. A. J. Cooper, Engineer, Easton, Pa.

GLOUCESTER, MASS.—It is said plans are being made by City Engineer W. L. Webber for the new "Squam" bridge. (Construction Supplement, March 14, 1902.)

GRAND RAPIDS, MICH.—The North Park Bridge Co. has been incorporated to build a bridge across Grand River at North Park, Kent County. The capital stock is \$25,000, and the stockholders are: G. S. Johnston, L. J. Rindge, T. F. Carroll, Wm. H. Anderson, J. A. Covode and others, of Grand Rapids.

It has been voted to issue \$150,000 of bonds for building the Wealthy avenue bridge and the Bridge street bridge. (Construction Supplement, March 14, 1902.) I. F. Lamoreaux, City Clerk.

GRAY'S POINT, MO.—Contract for building the approaches to the new railroad bridge over the Mississippi River between Thebes and Gray's Point, is let to McArthur Bros., of Chicago. This work will cost about \$200,000. Bids for the superstructure are now being received at the office of the Southern Illinois & Missouri Bridge Co. The engineers for this bridge, which has been mentioned several times in the *Railroad Gazette*, and illustrated March 14, p. 187, are Messrs. Alfred Noble and Ralph Mojleski, 1742 Monadnock Block, Chicago, Ill.

GREAT VALLEY, N. Y.—The New York State Railroad Commission has ordered an under crossing under the Buffalo, Rochester & Pittsburgh in the town of Great Valley.

HARRISBURG, PA.—Viewers have been appointed to consider the advisability of rebuilding a number of bridges in Bradford County.

HAZLETON, PA.—The Commissioners of Carbon and Luzerne Counties have endeavor to have the State rebuild the bridge at White Haven and viewers have been appointed.

HINSDALE, MASS.—This town is considering the advisability of making a loan of \$75,000 to \$100,000 for building a new bridge over the canal in South Main street and for other purposes.

INDIANAPOLIS, IND.—Bids are wanted May 6 by the Board of Commissioners of Marion County for building the proposed bridge over White River at West Washington street, according to plans on file with the County Auditor, Harry B. Smith.

JACKSONVILLE, FLA.—The reconstruction of the Riverside avenue viaduct across the railroad tracks, connecting the business section of the city with Riverside, has been placed in charge of Hildreth & Co., Consulting Engineers, of New York. Preliminary plans and estimates are being made for steel and masonry structures. The new viaduct will be 1,200 ft. long and 60 ft. wide, with a new elevated roadway connecting with the second story of a proposed warehouse and work necessary to change three existing incline connections to freight yards. The work will be undertaken jointly by the city, the Plant System, the Seaboard Air Line, the Jacksonville Terminal Co., and the Jacksonville Street Ry.

JEFFERSON CITY, MO.—Contracts will be let by B. C. Bond, County Surveyor of Cole County, on May 6, at the Court House in Jefferson City, for a considerable amount of bridge work.

JOHNSTOWN, PA.—The County Commissioners will not build a dozen new bridges this summer as currently reported, but we understand two bridges may possibly be built this summer.

LAFAYETTE, IND.—Bids are wanted May 3 for some bridges and steel culverts in Tippecanoe County. Geo. A. Jamison, County Auditor.

LEBANON, PA.—Viewers have been appointed by the Dauphin County Court to consider rebuilding by the State of the partially destroyed bridge over the Schuylkill at Cross Keys.

LONDON, ONT.—The Lake Erie & Detroit River Ry. propose to rebuild bridges over the south branch of the Thames River and Kettle Creek; estimated cost, \$25,000.

Mr. Talbot, County Commissioner, has been instructed by the township of West Missouri to prepare plans and invite bids for a steel bridge with concrete abutments.

MADISONVILLE, TENN.—The Monroe County Court has authorized a bridge over the Tellico River of three steel spans.

MILES CITY, MONT.—Bids are wanted until April 23 for a bridge over Little Missouri River by the County Commissioners.

MINNEAPOLIS, MINN.—A bill is before Congress authorizing a bridge over Devil's Lake south of Crary.

Bids are wanted April 25 by the City Council for building a bridge on Third avenue southeast from Main street to Hennepin Island. Plans are with the City Engineer.

MORGANTOWN, W. VA.—Geo. C. Sturgiss, President of the Central R. R. of West Virginia, writes us that he would like to hear from contractors and bridge builders in regard to building a railroad, highway and trolley line bridge, with relative cost, over the Monongahela River and the Baltimore & Ohio R. R. The elevation will be about 51 ft. above low-water mark and the bridge will probably be about 700 ft. long, consisting of about two deck or two through spans, the channel span to be about 280 ft. or 285 ft. The other spans to be about 200 ft. or less.

NASHVILLE, TENN.—The County Court is considering building about six bridges over turnpikes in the county. The total cost will be about \$8,000.

NEW CASTLE, IND.—J. E. Troyer is reported making plans for 29 bridges to be built in Henry County this summer.

OACOMA, S. DAK.—The U. S. Senate on April 11 passed a bill authorizing the Federal Railroad Co. to build a combined railroad, wagon and foot-passenger bridge across the Missouri River, at or near Oacoma, S. Dak.

OMAHA, NEB.—The bridge authorized by Congress over the Missouri River at South Omaha is said to be in the interest of the Omaha extension of the Chicago Great Western.

PEN ARGYL, PA.—The Lehigh & New England R. R.

is about to get bids on some bridge work which includes a 154 ft. steel bridge; also a plate girder 60 ft. long.

PINEVILLE, KY.—The Fiscal Court of Belle County has decided to add a 130-ft. span to the Pine street bridge across the Cumberland, to take the place of the present wooden span. County Judge L. K. Rice, H. H. Fuson and C. Carr were appointed a committee to receive bids.

PITTSBURGH, PA.—It is said that plans have been made by the Pennsylvania R. R. for the new bridge to cross the Monongahela River at Port Perry. It is to be a double track structure to replace the present single track bridge. About 3,500 tons of steel will be needed.

PORTLAND, ME.—The city officers are considering the matter of Vaughan's bridge. The estimates on this structure call for a bridge to cost between \$230,000 and \$250,000. The Portland Street R. R. Co. will pay about 20 per cent. of this cost.

PUEBLO, COLO.—The city has appropriated \$20,000 toward the Main street viaduct, the total cost of which will be \$60,000. The railroads are asked to give assistance.

PULASKI, TENN.—The County Court has appropriated \$30,000 for replacing bridges recently destroyed.

RICHMOND, QUE.—It is said that bids will be wanted pretty soon for building the new St. Francis bridge between Richmond and Melbourne. L. A. Vallee is the Government Engineer.

RUMFORD FALLS, ME.—Parker Spofford, part owner in the toll bridge between Rumford and Mexico, is reported as saying that it has been decided to raise the bridge about two feet.

ST. LOUIS, MO.—We are told that the St. Louis, Memphis & South Eastern R. R., a new corporation, will want bids for a pin-connected bridge 250 ft. long near St. Louis, to cost about \$75,000. S. E. Coombs, Chief Engineer, 510 Granite Block, St. Louis.

The Missouri Pacific Ry. has recently let a contract to the Phoenix Bridge Co. for 3,000 tons of single track plate girder spans varying in length from 35 ft. to 83 ft.

ST. PAUL, MINN.—Judge Kelly in the District Court has ordered the "Soo Line" to put a bridge across the tracks at Rice street.

SCRANTON, PA.—Joseph P. Phillips, Chief Engineer of the Department of Public Works, writes us that two bridges are to be built in Scranton. One about 116 ft. long and 50 ft. wide will be built over Lackawanna River at Race street. The plans for the structure are not yet determined upon. The other bridge will cross Roaring Brook on Ash street. It will be about 56 ft. long and 40 ft. wide.

Bids will soon be wanted by the Commissioners of Lackawanna County for eight bridges. Contractors are to submit their own plans.

SPARTANBURG, N. C.—Bids are wanted May 8 for a 120 ft. steel bridge. F. H. Knox, City Engineer.

STRUTHERS, OHIO.—We are told that the bridge proposed to the property of the Youngstown Iron Sheet & Tube Co. will be built by the Pittsburgh & Lake Erie R. R. J. A. Atwood, Chief Engineer, can give information.

SYDNEY, NEW SOUTH WALES.—The time for submitting bids, with designs, for the bridge to cross Sydney Harbor, has been extended until June 30. As previously reported, the main span of this bridge is to be not less than 1,200 ft., total length of bridge being 3,000 ft. Particulars can be had from the British Consul, Percy Sanderson, No. 17 State street, New York City.

SYRACUSE, N. Y.—It is said that plans are being made for improving the Bridge street bridge.

TERRE HAUTE, IND.—The County Commissioners will receive bids on May 7 for 13 new bridges as follows: Sterling and Haley bridges, Honey Creek Township; Grant bridge, Nevins; Bowen bridge, Prairie Creek; Salt Creek bridge, Fayette; Twenty-first street and Fruit Ridge bridges, Harrison; Davis and Hayworth bridges, Linton; Bemeyer bridge, Riley; Rush bridge, Pierson, and Soules bridge, Lost Creek.

TYNDALL, S. D.—Bids will be received by the County Auditor of Bon Homme County, at the Court House in Tyndall, on May 3, for furnishing and building all bridges, both steel and wood, that may be ordered by the Board of County Commissioners for the ensuing year. T. H. Abbott, County Auditor.

VALDOSTA, GA.—Bids are wanted May 7 for a bridge 172 ft. long, consisting of one 136 ft. steel span, on which bids are wanted by the Commissioners of Roads and Revenues of Lowndes County.

WASHINGTON, D. C.—We are told that bids will be wanted some time in June for five steel bridges for the Washington, Westminster & Gettysburg Ry., which will aggregate about \$25,000. The New York office is 20 Broad street.

WELLSVILLE, OHIO.—The City Council is considering the Lisbon street bridge improvement. The county has agreed to pay the cost of raising the bridge provided the city of Wellsville will build the approaches.

WEST MILTON, VT.—A report has been submitted to the city officers in regard to building a bridge over Lamotte River at West Milton. A steel bridge is estimated to cost \$14,000.

WILLIMANTIC, CONN.—This town is considering building a new bridge over Willimantic River. Plans were made some time ago, and it is now said the bridge will cost about \$50,000.

WINNIPEG, MAN.—The City Engineer writes that a subway is proposed under the tracks of the Canadian Pacific at Point Douglas, but no details have yet been decided upon.

Other Structures.

BALTIMORE, MD.—The directors of the Wm. Skinner & Sons Shipbuilding & Dry Dock Co. have authorized an increase in capital stock of about \$500,000. The addition to the capital will be used for building a large machine shop, a boiler making plant and a general repair shop.

BOWLING GREEN, KY.—The Cincinnati, Hamilton & Dayton has plans ready for a station in this city.

BRADDOCK, PA.—The Baltimore & Ohio, it is said, contemplates improvements at Braddock this summer which include a new station.

COLUMBUS, GA.—Fire on April 10 destroyed the shops of the Southern Plov Works; also the trestle work of the Mobile & Girard R. R. from Front street to the river, a distance of nearly two blocks.

GENEVA, N. Y.—An officer of the New York Central writes that nothing has been decided in regard to building a new station in this city.

HANNIBAL, MO.—The Treat Mfg. Co. is making arrangements to further increase the facilities to make car wheels at its plant in this city.

KEY WEST, FLA.—We are told that bids will be received before the end of the month for some piers for the Peninsula & Occidental Steamship Co., for which Hildreth & Co., New York City, are the engineers.

LAFAYETTE, IND.—The Big Four and the Lake Erie & Western will spend about \$50,000 on improvements at Lafayette. A joint passenger station will cost \$16,000, and the Big Four is building a new freight house.

MANKATO, MINN.—A joint station for the Chicago, Milwaukee & St. Paul and the Chicago Great Western is proposed on Jackson street, this city.

NEWARK, N. J.—It is said that work will shortly be begun by the International Steam Pump Co. on its new plant in Harrison. Bids are being received on the different work. The cost of the structure will aggregate \$500,000.

Bids are being received by the Delaware, Lackawanna & Western for the new passenger station in Newark. It will be of stone, 36 x 110 ft., with a shelter way 30 x 130 ft. Plans may be seen at the office of the company, Hoboken.

NORTH TONAWANDA, N. Y.—A new station is proposed by the New York Central at this place. It is said preliminary work has been begun.

READING, PA.—The Reading Railway, which has been giving considerable attention of late to the building of new passenger stations to replace some of the old structures at various points on the system, will, it is said, next take up the question of a new building at Auburn. New stations at Royersford and Pottstown are also said to be under consideration.

ROCKMART, GA.—The Southern States Portland Cement Co. is being formed by W. F. Cowham, President of the National Portland Cement Co., Jackson, Mich.; A. F. MacLaren, Toronto, Can.; Frank Hawkins, President, Third National Bank, Atlanta, Ga., and other men from various Southern cities. It is said the company has about 300 acres of land at Rockmart, and will build a plant with a daily capacity of 1,200 bbls. of cement.

ROME, N. Y.—An officer of the New York Central writes that the company has not decided as yet in regard to building the new passenger station in Rome.

ST. JOSEPH, MO.—The Union Terminal Railway Co. has decided to build a terminal passenger and freight depot at Fourth and Mesarie streets at an estimated cost of \$500,000.

SPRINGFIELD, ILL.—The Big Four will build a number of new stations on the Peoria & Indianapolis Division this summer. Work has already been begun at Fithian and Pittsboro. Other stations are to be located at Urbana and Bloomington. They will all be brick structures.

TOLEDO, OHIO.—Pickands, Mather & Co., of Cleveland, are making contracts with various firms for building parts of the blast furnace and ore dock at Toledo. Some contracts are let and others are to be let soon.

WASHINGTON, D. C.—Bids are wanted at the Bureau of Yards and Docks, Navy Department, Washington, at 1 o'clock May 24, for building a brick and steel building at the Navy Yard, Mare Island, Cal. Appropriation, \$92,400.

WORCESTER, MASS.—According to local report, Messrs. Frost, Briggs & Chamberlain have made plans for the city for a new union station to replace the present structure when the grade crossings are abolished.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xviii.)

American Association for the Advancement of Science.

The annual meetings of this Society and other Societies that hold meetings in conjunction with it, will be held in Pittsburgh, Pa., from June 28 to July 3.

New England Railroad Superintendents' Association.

I. N. Marshall, Superintendent of the Taunton Division of the New York, New Haven & Hartford, has been elected President of the New England Railroad Superintendents' Association.

Pacific Coast Railway Club.

The meeting on March 15 was devoted to a paper by President W. S. Palmer on "Track and Bridge Inspection; Essential Features for Safe Operation," also answers to questions on "Cleaning Cars at Terminals," and "Cost of Running High-Speed Trains."

New York Railroad Club.

The Secretary announces that he has on hand a number of copies bound of Volume XI. of the *Proceedings* of the Club containing the papers and discussions of the past year. The price is \$2; the secretary is Mr. W. B. Yence, 168 Montague street, Brooklyn, N. Y.

American Society of Civil Engineers.

At the meeting on Wednesday, April 16, at 8:30 p.m., two papers were presented for discussion as follows: "Is It Unprofessional for an Engineer to be a Patentee?" by Archibald R. Eldridge, M. Am. Soc. C. E., and "The Stiffening System of Long-Span Suspension Bridges for Railroad Trains," by Joseph Mayer, M. Am. Soc. C. E. These papers were printed in the *Proceedings* for February, 1902.

Massachusetts Street Railway Association.

The regular monthly meeting of the Massachusetts Street Railway Association was held at Mass's Hotel, Boston, Wednesday, April 9. Mr. George B. Francis, Chief Engineer of the Union Railroad Company, Providence, R. I., was the guest of the evening, and read a paper entitled, "Improvements in Street Railroad Construction." Mr. Francis was formerly Resident Engineer of the Boston Terminal Company, and came to the Union Railroad Company after an experience of more than 15 years in steam railroad engineering. In the comparatively short time that Mr. Francis has been with the Union Railroad Company much important work has been done.

The peculiarities of street railroads which impress a steam railroad engineer are: The greater cost of street tracks per mile, under city conditions; the fact that tracks are laid under the supervision of highway surveyors, who are generally quite unfamiliar with the requirements; the elevation of outer rail. Street conditions sometimes require a depression instead of an elevation; loose switch points. Nothing of this kind is found in steam railroads and it will be a relief to street railroad men when a reasonable method is found to fasten the points while they are run over; the small flanges on street car wheels and the trouble had with chipped flanges due to running over special work.

The power station now under construction covers an area of about 200 by 150 ft., and is built on about 5,000 piles, from 50 to 60 ft. long, which passed through about 40 ft. of mud and filling to a reasonably good bottom. These piles are capped with four feet of Portland cement concrete and surrounded by a sheet pile cofferdam made of 6 in. spliced hard pine in 40-ft. lengths. The superstructure is a brick and steel structure about 75 ft. high. The boiler room supports coal pockets of 2,500 tons capacity. The eight boilers are Babcock and Wilcox 500 h.p. water-tube boilers, and they will be equipped with Roney mechanical stokers and mechanical draught. Coal conveying machinery will also be installed. The engine room will contain two 1,500 K. W. alternating current generators, one 1,500 K. W. and one 1,250 K. W. direct current generators. The contract cost of this building, including foundations, is 10 1/10 cents per cu. ft.

PERSONAL.

—Mr. John W. Green, at one time General Manager of the Georgia Railroad, died April 11, at Atlanta, Ga. Mr. Green was born at Darien, Ga., in 1834.

—Mr. J. E. Muhfeld, Superintendent of Rolling Stock and Machinery of the Intercolonial, and Miss Marie Murphy were married on April 14, at Chicago, Ill.

—Mr. T. M. Bradbury, of Jefferson City, Mo., was on April 6, elected Secretary of the Missouri State Board of Railroad and Warehouse Commissioners to succeed the late Mr. Harding.

—The University of Edinburgh, Scotland, has conferred upon Mr. John Lunde the degree of Doctor of Science (D. Sc.) in recognition of his work in electric traction. This degree, from the University of Maxwell, Tait and Jenkin, has been given to but few engineers and rarely except for original work.

—As announced last week, Mr. C. A. Goodnow, General Superintendent of the Chicago, Milwaukee & St. Paul, has been chosen General Manager of the Chicago, Rock Island & Pacific. We gave a brief sketch of Mr. Goodnow's life at the time he assumed the General Superintendency of the Chicago, Milwaukee & St. Paul, and it will be found in our issue of Dec. 28, 1900, page 867.

—Mr. Jackson H. Buckalew, Master Mechanic of the Southern Railway, with headquarters at Memphis, Tenn., died April 7. Mr. Buckalew was a native of South Carolina, having been born at Anderson in 1834. His railroad service dates from 1851. From then until 1887, when he became Master Mechanic of the Memphis & Charleston and its successor the Southern, he passed through various positions such as brakeman, engineman, machinist, foreman and general foreman.

—Mr. M. S. Blair, General Superintendent of the Pittsburgh, Shawmut & Northern, died April 14. Mr. Blair, as Auditor of the Allegheny Central, entered railroad service in 1882, and from that date until 1889, he was Auditor and Assistant Treasurer of the Lackawanna & Pittsburgh. In the last named year he was appointed Receiver of the Rochester, Hornellsville & Lackawanna, and the Lackawanna & Southwestern, until 1892, when he became General Superintendent of the Central New York & Western and its successor, the Pittsburgh, Shawmut & Northern.

—Mr. J. B. Warrington, now Superintendent of the Philadelphia Division of the Philadelphia & Reading, entered the service of the road in 1876, as a car cleaner. He was made yard brakeman and later entered the freight service, rising to the position of conductor. Four years later he became assistant trainmaster, despatcher and a short time afterwards train despatcher at Reading, remaining there until 1888. He was made yardmaster until 1895, when he was transferred to West Falls and in 1899 became assistant trainmaster, which position he held until the present time. Mr. Warrington was born April 21, 1866.

—Mr. T. L. Smith, the new Master Mechanic of the St. Louis Division of the Chicago, Burlington & Quincy at Beardstown, Ill., was born near Zanesville, Ohio, in 1854. He served his apprenticeship with the Baltimore & Ohio at Newark, Ohio, after which he went with the Pennsylvania, and remained there until 1876, when he returned to the Baltimore & Ohio, but again resigned in 1881, to go with the Chicago, Burlington & Quincy as a machinist, and was subsequently made gang boss, roundhouse foreman, road foreman of engines, Assistant Master Mechanic of the Chicago Division, and finally Master Mechanic of the St. Louis Division, assuming his new duties April 1 last.

—The new Division Engineer of the Baltimore & Ohio, Mr. J. G. Bloom, graduated from the Ohio State University as a civil engineer in 1889 and was for a few months chairman on the Pittsburgh, Cincinnati, Chicago & St. Louis. He then became Assistant Engineer for the Kenova Land Association. From this position he went to the Norfolk & Western as Assistant Supervisor of the Norfolk Division. In April, 1892, he went with the Baltimore & Ohio Southwestern as a draftsman, and the following year was made First Assistant Engineer, and in 1895 became Division Engineer. In June, 1896, he was appointed Principal Assistant Engineer and Division Engineer of the Ohio Division in 1900, where he remained until April 1, this year, when he was promoted as Division Engineer of the New Castle Division of the Baltimore & Ohio.

—Mr. C. A. Morse, Principal Assistant Engineer of the Atchison, Topeka & Santa Fe, has been with the Santa Fe for the past 16 years. He was born at Bangor, Me., in 1859, and was educated at the Maine State College (engineering department), and entered railroad service in 1880 in a clerical position on the Chicago, Burlington & Quincy. From 1881, until the completion of the road in 1884, he was Division Engineer of the Mexican Central. Then for one and a half years he again took service with the Burlington. From 1886 he has been with the Santa Fe. His first service with this company was as a Division and Resident Engineer. He then held a similar position on the Western, Colorado, New Mexico & Rio Grande Divisions at Pueblo, Colo., and from then, until his new appointment as above, Mr. Morse was Assistant Engineer in the Chief Engineer's office at Topeka, Kan.

—Mr. George Gibbs has been added to the Pennsylvania Railroad Company's Commission in charge of the studies for the tunnels under the Hudson River and the East River. It will be remembered that the Commission is made up of Colonel Raymond, U. S. A.; Mr. Brown, Chief Engineer Pennsylvania Railroad; Mr. Noble, Mr. Jacobs and Mr. Lindenthal. Mr. Gibbs is now added as a sixth member. Undoubtedly he has been joined to the Commission for the particular purpose of studying the traction and transportation side of the question, and it is wise that this study should be taken up at once, for, after all, the tunnels are designed for transportation.

Mr. Gibbs is also to act as Consulting Engineer in the Atlantic avenue improvement of the Long Island Railroad in Brooklyn. He remains as Consulting Engineer of the Rapid Transit Subway Construction Co.

—Mr. Benjamin McKeen who succeeds Mr. C. S. Sims as Superintendent of the Chicago Terminal Division of the Pennsylvania Lines West of Pittsburgh, comes to this position from the Vandalia, where he has been Superintendent of the Main Line Division. Mr. McKeen is a son of Wm. R. McKeen, former President of the Terre Haute & Indianapolis. He is a graduate from the Civil Engineering course of Rose Polytechnic Institute, Terre Haute, Ind., and entered railroad service in 1886 as a chairman on the Terre Haute & Logansport Division of the Vandalia. In 1887 he became Engineer of Maintenance of Way, filling that position until Jan. 5, 1894, at which time he was made Superintendent of the Peoria Division of the Vandalia. He was transferred to the Main Line Division June 10, 1901, which he has just left for his present position. Mr. McKeen is a member of the American Society of Civil Engineers.

ELECTIONS AND APPOINTMENTS.

Algoma Central & Hudson Bay.—W. H. Cowell has been appointed Purchasing Agent.

Central of New Jersey.—J. A. Taylor, heretofore Auditor Freight Traffic and Assistant General Auditor, has been appointed General Auditor, succeeding W. W. Stevenson, resigned.

Chicago & Alton.—Charles Lindstrom, Mechanical Engineer, with headquarters at Bloomington, Ill., has resigned, effective May 1.

Chicago, Burlington & Quincy.—H. C. Nutt, heretofore Assistant Superintendent of the Iowa Lines, has been appointed Superintendent of these lines, succeeding C. M. Levey.

Chicago, Milwaukee & St. Paul.—Edward Laas has been appointed Superintendent of Construction.

C. A. Cosgrave, Assistant General Superintendent at Minneapolis, Minn., has resigned, to take effect about June 1.

Chicago Union Transfer.—M. E. Shire, heretofore Principal Assistant Engineer, has been appointed Engineer in Charge, succeeding A. Swantz, Chief Engineer, resigned.

Cincinnati, Hamilton & Dayton.—J. A. Gordon, heretofore Division Superintendent at Wellston, Ohio, has been appointed Division Superintendent, with headquarters at Dayton, succeeding A. Galloway, resigned.

Cincinnati, Richmond & Muncie.—R. M. Rogers has been appointed Traffic Manager.

Cleveland, Akron & Columbus.—The headquarters of the General Freight Agent have been removed from Cleveland to Columbus.

Crystal.—W. J. Golightly has been appointed Superintendent, with headquarters at Crystal City, Mo., succeeding P. R. Holbach, resigned.

Delaware, Lackawanna & Western.—Robert W. Day has been appointed Division Engineer, with headquarters at Hoboken, N. J., succeeding Mr. Mitchell. M. M. Stallman becomes Assistant Engineer.

Erie.—At the regular meeting of the Board of Directors held April 15, Daniel Willard, heretofore Assistant to the President, was elected Third Vice-President, to take effect immediately. He will be in direct charge of the operating department. Mr. Willard's previous term of service was on the Central Vermont, Lake Shore & Michigan Southern, the Soo Line and the Baltimore & Ohio.

Grand Trunk.—Ira W. Gantt, heretofore General Freight Agent of the Central Vermont, has been appointed Manager of the Grand Trunk Despatch, succeeding Wm. P. Fitzsimons, resigned, to become Manager of the Lackawanna-Grand Trunk Line.

Hillsboro.—J. R. Ruffin has been appointed General Freight Agent, succeeding E. F. Gray, resigned.

Houston & Texas Central.—J. M. Lee, heretofore Superintendent at Houston, Texas, has been appointed Superintendent of the Austin Division, succeeding A. N. Leitnaker, resigned.

Jacksonville & St. Louis.—G. W. Dye has been appointed General Passenger Agent, succeeding H. A. Bonn.

Macon, Dublin & Savannah.—A. L. Moler, Master Mechanic, with headquarters at Macon, Ga., has resigned. (See Queen & Crescent.)

Northern Pacific.—G. A. Kyle has been appointed Division Engineer, with headquarters at Tacoma, Wash.

Pecos System.—C. Tenyck has been appointed Superintendent, with headquarters at Amarillo, Texas.

Pennsylvania.—C. B. Price, Superintendent of the River and Low Grade Divisions of the Buffalo & Allegheny Valley Division, with headquarters at Pittsburgh, Pa., has resigned.

Pennsylvania Company.—Benjamin McKeen, heretofore Division Superintendent of the Vandalia Line, has been appointed Superintendent of the Chicago Terminal Division of the P. C., with headquarters at Chicago, Ill., succeeding C. S. Sims.

Plant System.—W. E. Symons, Superintendent of Motive Power, with headquarters at Savannah, Ga., has resigned. F. L. Pickering has been appointed General Passenger Agent, with headquarters at Tampa, Fla.

Queen & Crescent.—A. L. Moler, heretofore Master Mechanic of the Macon, Dublin & Savannah, has been appointed Master Mechanic of the Vicksburg, Shreveport & Pacific Division of the Q. & C., with headquarters at Monroe, La.

St. Louis & San Francisco.—G. H. Schleyer, heretofore Trainmaster, has been appointed Division Superintendent, with headquarters at Sapulpa, Ind. T.

Santa Fe Pacific.—G. R. Joughins has been appointed Mechanical Superintendent, with headquarters at San Bernardino, Cal.

Santa Fe, Prescott & Phoenix.—E. De Silva has been appointed Master Mechanic, with headquarters at Prescott, Ariz., succeeding W. J. Hemphill, resigned.

Sierra of California.—S. H. Smith has been appointed General Freight and Passenger Agent, succeeding W. F. Towne.

Southern Missouri & Arkansas.—G. H. Sullivan has been appointed Superintendent of Maintenance of Way.

Tennessee Central.—J. R. Michaels has been appointed Superintendent, succeeding H. W. Carlton, resigned.

Union Pacific.—Anson N. Ackley has been appointed Superintendent of Dining Car Service, with headquarters at Omaha, Neb.

Vandalia Line.—Maurice Coburn, heretofore Acting Engineer Maintenance of Way, has been appointed Engineer Maintenance of Way. J. O. Crockett has been appointed Superintendent of the Peoria Division, with headquarters at Terre Haute, Ind.

Weatherford, Mineral Wells & Northwestern.—The office of Assistant General Freight and Passenger Agent has been abolished and the duties assumed by the Vice-President and Superintendent.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ATLANTA, KNOXVILLE & NORTHERN.—An officer writes that an extension 45 miles long is to be built from Knoxville, Tenn., to a connection with the Louisville & Nashville at Jellico. For financial reasons, a new company has been incorporated under the name of the Knoxville, Lafollette & Jellico, of which the incorporators are T. R. Price, J. W. Green, M. S. McLellan, R. Hazen and others. Engineers are now in the field locating the line which will be begun as soon as the surveys are completed. John B. Newton, General Manager of the Atlanta, Knoxville & Northern, will be President, and H. W. Oliver, who holds the same office on the A., K. & N., will be Secretary and Treasurer. (See under Knoxville, Lafollette & Jellico, April 11, p. 278.)

BALSAM LAKE & WESTERN.—This company filed articles of incorporation in Wisconsin April 8. It is proposed to build from Balsam Lake, Wis., to St. Croix Falls, 12 miles. The incorporators are W. H. Hooper, Alonzo Tuttle and others of Balsam Lake.

BENNETTSVILLE & OSBORN.—This company has been organized in South Carolina to build a railroad 12 miles long from Bennettsville to a connection with the Seaboard Air Line at Kollock. It is said that surveys have been made already. J. A. Drake is President.

BILLINGS & NORTHERN.—Articles of incorporation for this proposed road were filed in Montana April 10. It is intended to build in the interest of the Chicago, Burlington & Quincy from Billings to Great Falls, Mont., a distance of about 185 miles. The list of incorporators is said to be composed exclusively of officers of the Burlington.

CANADIAN NORTHERN.—The contract between the British Columbia Government and Mackenzie & Mann, contractors, for the extension from the Yellowhead Pass of the Rocky Mountains in British Columbia, to Bute Inlet, on the Pacific, was brought before the Legislature March 25. It is provided that the company shall be granted a land subsidy which varies between \$4,000 and \$4,800 a mile, according to the location. The lands are to be exempt from taxation until alienated, and the railroad is to be exempt for 10 years after completion.

CANANEA CONSOLIDATED COPPER.—This road is reported opened for business from Naco, Ariz., to Cananea, Mexico, 42 miles.

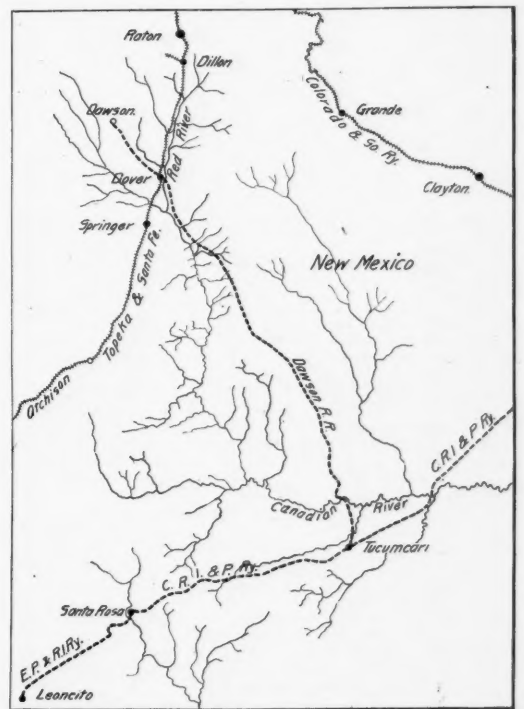
CHICAGO & NORTH WESTERN.—A branch from Grand Rapids, Wis., to Nekoosa, seven miles, is reported opened.

CHOCTAW NORTHERN.—The Anthony branch is reported opened from Ingersoll, Okla. T., northward to Anthony, Kan., 33 miles.

CHOCTAW, OKLAHOMA & GULF.—The Ardmore Branch, which is to run from Haileyville, Ind. T., southwest to Ardmore, on the Atchison, Topeka & Santa Fe, was reported to have been opened from Haileyville to Tishomingo on April 14. Tishomingo is about 95 miles from Haileyville and the total length of the extension, when completed, is to be 118 miles, passing through Kiowa, Coalgate, Wapanucka and other towns. (Construction Supplement, March 14, 1902.)

DALLAS & NEW MEXICO.—This company which proposes to run a line from Dallas to Boyd, Texas, and has secured the unused grade of the old Dallas, Archer & Pacific for a part of the distance, has, it is said, made financial arrangements which will enable it to proceed at once with the first division of the line west from Dallas. The incorporators were H. M. Skelton and others, of Dallas.

DAWSON (CHICAGO, ROCK ISLAND & PACIFIC).—An officer writes in regard to this new line from Tucumcari, N.



Mex., on the Chicago, Rock Island & Pacific, 133 miles northwest to Dawson, N. Mex., that surveys are completed and grading is in progress. About 40 miles of grading have now been finished by Geo. S. Goode & Co., who also have the contract for track laying. Track laying has just begun at French, the junction point of the Dawson with the Atchison, Topeka & Santa Fe, and is proceeding northwest toward Dawson. Forty miles of the work is

very heavy, with considerable rock; the balance is medium. The maximum grade is practically one per cent., except that at one point there is a short piece of 2 per cent. grade. Maximum curvature is 10 deg. There are six iron and steel bridges as follows: Canadian River crossing, 175 ft., through pin span, and one 80 ft. deck plate girder; Red River, 125 ft. deck lattice span; Pajarito Creek, 80 ft. deck plate girder; Atarque Creek, three crossings; two 60 ft. deck plate girders, and one 50 ft. deck plate girder. The American Bridge Co. has the contract for these. The rolling stock has been bought from the Baldwin Locomotive Works and the American Car & Foundry Co., respectively. The sketch shows the plan of the route.

DONORA SOUTHERN.—This company was incorporated in Pennsylvania March 28, to build a railroad 3½ miles long from a point near Bradford, Washington County, on the Pittsburgh, Virginia & Charleston, to a point near Baird Station, on the same line. W. H. Donner, Pittsburgh, is President.

EAST & WEST OF GEORGIA.—An officer writes that grading is now entirely completed on this new line in Georgia from Sparta to Sandersville, Washington County, 27 miles. No track has yet been laid, but 3,500 tons of 70-lb. steel rails have been delivered at Savannah. W. B. Bennett, of Sandersville, is President.

FREDERICTON & WESTERN.—A bill to incorporate this company and a connecting line to be known as the Moncton & Eastern, was introduced in the New Brunswick Parliament April 9. It was there stated that the project was in the interest of the Webb-Vanderbilt Syndicate in connection with the purchase of the Canada Atlantic, and the new lines in New Brunswick would form part of a through route from the west to Cape Breton. The bill gives the companies power to purchase charters of other railroad companies.

ILLINOIS CENTRAL.—An officer writes that within a few weeks the company will have a double track throughout the length of its main line from Chicago to Cairo, 380 miles. The line is already double tracked for about two-thirds of this distance, and the work on the remaining part is nearly finished. Within about 18 months the line will be double-tracked all the way from Chicago to New Orleans, except that portion which is paralleled by the Yazoo & Mississippi Valley. There is now a second track for 50 miles between Cairo and Fulton, Ky., and a similar length in Mississippi between Crystal Springs and Brook Haven.

Work is reported in progress from Reevesville, on the line between St. Louis and Paducah, east to Golconda, on the Ohio River; 16 miles. A line 32 miles on the Kentucky side of the Ohio River is also being built.

INTEROCEANIC OF MEXICO.—The Teziutlan Division is reported opened from Virreyes, Mexico, north to Teziutlan, 50 miles, with a branch eight miles long from Concepcion to San Juan.

IOWA CENTRAL.—Contract has been let to the P. T. Walsh Construction Co., of Davenport, Iowa, for reduction of the grade south of Grinnell, Iowa.

KANAWHA & MICHIGAN.—An officer writes in regard to reports of track raising on the line to prevent floods from interfering with the traffic, that the road is merely being supplied with permanent ballast. The material used is furnace slag, of which great quantities are received from the furnaces gratuitously.

LONG ISLAND.—It is said that the Far Rockaway branch will be double-tracked this year between Valley Stream and Lawrence, four miles, which will complete the double-tracking on this division between Long Island City and Brooklyn and Rockaway Beach. The estimated cost is about \$50,000, and it is expected to begin work in the fall.

MARYLAND ROADS.—Work is reported in progress on a spur line two miles long from the Washington branch of the Baltimore & Ohio at Savage Station, to the Maryland Granite Company's quarries at Guilford.

It is said that the owners of the Liberty copper mines near Woodsboro, Frederick County, will build a short railroad to connect their plant with either the Pennsylvania or the Western Maryland.

MASON & OCEANA.—Amended articles of association have been filed increasing the capital stock to \$380,000, and providing for the extension of the line from its present terminus to Grand Rapids. Maps of the line have also been approved by the Board of Railroad Crossings and no crossings of other roads are to be made at grade. The line has been completed for some time between Buttersville and Walkerville, 27 miles, and work on an extension to Hesperia was begun last October. Grand Rapids is about 50 miles from Hesperia. (Feb. 14, p. 121.)

MICHIGAN CENTRAL.—Maps have been filed by this company showing a proposed extension of a belt line in Bay City to reach the property of some beet sugar companies and some manufacturing plants on Harper avenue in Detroit.

MINNEAPOLIS & ST. LOUIS.—Contract is reported let to the P. T. Walsh Construction Co., of Davenport, Iowa, for 10 miles of new line to avoid the present steep grade over Chaska Hill at Chaska, Minn. A number of other grades are also to be removed. (Nov. 1, 1901, p. 764.)

NEW YORK CENTRAL & HUDSON RIVER.—In reference to improvements on the Pennsylvania Division, an officer writes that contracts for double tracking are about to be let at Rock Stream for 2½ miles; between Corning and Wentz, 15.6 miles; from Leaches to Middlebury, 5.6 miles, and from Pine Creek Junction to Torbett's, two miles, a total of 25.7 miles. Contracts are also to be let to lengthen nine sidings to admit of two full length trains, one in each direction, with intermediate cross-overs. Grades are being reduced southbound at five points on the line, and northbound at three. (See article in the *Railroad Gazette* March 14, 1902.)

NEW YORK CONNECTING.—This project for a double track road to connect the Long Island and the New York, New Haven & Hartford systems, passed last January into the control of the Pennsylvania, which intends to complete the work in connection with the N. Y., N. H. & H., so as to form a continuous line from Brooklyn to Port Morris. Arrangements will probably be made early in the summer to continue building. In the meantime additional rights of way will be secured. The work includes a cantilever bridge of 800 ft. span across the East River at Astoria, which will probably take about 18 months to build.

NEW YORK, ONTARIO & WESTERN.—President Fowler is quoted as saying that it had been decided to recommend to the Board of Directors to double track 107 miles of main line between Cadonia, which is the junction point of the Scranton branch, and Cornwall, N. Y. The work is to be begun at once and the expense met with the company's net earnings. It is intended, therefore, to spread the work out over three or four years, beginning with the most congested points. The estimated cost is about \$15,000 a mile.

NORFOLK & WESTERN.—An officer writes that change of line is now in progress at two points between Kenova and Columbus, Ohio. One of these involves a change of about four miles of track west of Portsmouth and cuts out several small bridges which will be replaced by stone arches. The other change covers about the same length of track west of Chillicothe, but does not include any heavy bridge work. Contracts for all this work have been let locally except the bridges, which are under contract to the American Bridge Co.

NORTHERN PACIFIC.—It is said that grading contract for 60 miles is to be let shortly on the extension from Hoquiam, Wash., along the north shore of Gray's Harbor. Work is now reported almost completed on grading the first section of this line, 24 miles long, which was let last year to Nelson Bennett. (Construction Supplement, March 14, 1902.)

NORTH RIVER (ELECTRIC).—A company by this name was incorporated at Albany April 5, to build a railroad to be operated by some other power than steam, from Saratoga Springs, N. Y., to South Glens Falls, 18 miles. The directors are: B. J. Town, J. W. Howe and others, of Saratoga Springs.

PENNSYLVANIA.—Contract for the third track from Bacon Hill to Iron Hill, Cecil County, Md., by the Maryland Division of the Philadelphia, Wilmington & Baltimore, has been let to Reiter, Hill & Curtis, of Philadelphia. It is said that work will be commenced at once.

Contract to extend the yard at Altoona, Pa., six miles east to Bellwood, is reported let to H. S. Kerbaugh, of Philadelphia. The amount is said to be \$450,000.

ST. LOUIS & SAN FRANCISCO.—It is said that the proposition of the town of Sulphur, Ind. T., for a branch line to be built from Hickory, nine miles distant, has been accepted. The branch could be built without involving any difficult work and it is thought that it will be begun at once.

ST. LOUIS SOUTHWESTERN.—At a recent meeting of the directors it was decided to build an extension from Lufkin, Texas, to Orange, by way of Beaumont, a distance of 100 miles. This extension, together with several others, was provided for in an amendment to the company's charter which was filed last fall.

SEWARD.—This company was incorporated in Pennsylvania April 7, to build a railroad five miles long from a point near the "Y. K." tower on the Pennsylvania in Westmoreland County, Pa., to Big Spring, St. Clair Township, in the same county. John E. Evans, Ebensburg, Pa., is President.

SOUTH & WESTERN.—This company, which was incorporated in North Carolina last January, filed articles April 1 in Kentucky. The road is to be 40 miles long, from a point on the Virginia line in Pikeville, Pike County, Ky., and will open up coal fields. It is said that this stretch will be built at once.

TENNESSEE CENTRAL.—According to most recent reports, 33 miles have been graded on the line between Lebanon, Tenn., and Nashville, which was let last spring to the Tennessee Construction Co. Twenty-three miles of track have been let. (Feb. 28, p. 154.)

TEXAS ROADS.—The State of Texas is to build a railroad two miles long to connect the sugar plantation operated by convicts in Brazoria County, with a point on the Brazos River. This road is to be operated as a part of the State penitentiary system.

Work was reported begun April 4 on a spur line four miles long from Tucker, near Palestine, to adjacent salt mines.

UNION TERMINAL OF NEW JERSEY.—This company was incorporated in Trenton April 11, to supplement the Union Terminal Co., incorporated last February in New York, and will carry on the New Jersey part of the project to tunnel the Hudson River independent of the proposed Pennsylvania tunnel and of the New York & Jersey project. The incorporators are: Wm. Van Hardenburg, 44 East Thirty-fourth street, New York; Edward C. Palmer, Morristown, N. J.; Roy Stone, New York, and others. (Construction Supplement, March 14, 1902.)

UTAH ROADS.—It is said that a line 40 miles long will be built from a connection with the Southern Pacific, in the northern part of Utah, through the Bear River Valley to Malad, Idaho, extending through a sugar beet country. It is to be built by the Utah Sugar Co., and as the articles of this company do not provide for any other business except sugar manufacture, a separate company will be formed for the railroad.

WABASH.—It is said that it has been decided to double track the 23 miles of line between Mingo Junction and Jewett, Ohio, connecting with the Wheeling & Lake Erie and the Pittsburgh, Carnegie & Western.

WARREN & YOUNGVILLE STREET.—This company was incorporated in Pennsylvania April 5, to build an electric road 10 miles long from a point in the Borough of Warren, to Youngville. Edward D. Wetmore, Warren, Pa., is President.

WESTERN ALLEGHENY.—A railroad company to build from a point on the Bessemer & Lake Erie near Euclid, Butler County, Pa., to a point near Kaylor, Armstrong County, a distance of 13 miles, was incorporated April 2, with the above title. James H. Beal, of Pittsburgh, is President.

ZANESVILLE TERMINAL.—This company was incorporated at Columbus, Ohio, April 8, by W. D. McKinnie, E. L. McCune, J. E. Merion and others. It is proposed to build a steam railroad connecting East Zanesville, Enterprise and Muskingum in Muskingum County, Ohio. The incorporators are all connected officially with the Columbus, Shawnee & Hocking.

GENERAL RAILROAD NEWS.

CANADIAN PACIFIC.—In a report by President Shaughnessy it is stated that the company's land sales during the past eight months were by far the largest in the history of the road, being 78,903 acres, which realized \$2,482,762. During the same period \$1,500,000 5 per cent. land grant bonds were drawn for redemption, thus reducing fixed charges by \$73,000 annually. This leaves outstanding only \$1,314,000 of these bonds, which it is hoped will be taken up with the proceeds of land sales in the near future.

CHICAGO, INDIANAPOLIS & LOUISVILLE.—This company has, for the first time, declared a dividend on its common stock. It is 1 per cent. and calls for \$105,000. The company had a surplus balance for the year ending June 30, 1901, after paying 4 per cent. on the preferred shares, of \$452,774.

CHICAGO, ROCK ISLAND & PACIFIC.—Official statements April 10 confirm the change of control of the Choctaw, Oklahoma & Gulf to the above railroad. The price was \$80 for the common stock, and \$60 for the preferred, and, under the terms of the sale thus made, the pur-

chasers agreed to take at the same price all stock offered. A majority of the stock has been sold to Speyer & Co., and a circular requesting stockholders to deposit their holdings with the Girard Trust Co., Philadelphia, is to be issued shortly. The situation which confronted the Choctaw was a choice of selling at the price offered, or of spending a large sum of money in betterments and extension of the line to meet increased competition from the Rock Island.

GRAND RAPIDS & INDIANA.—The Supreme Court of the State of Michigan has recently handed down a decision in the matter of the order issued by the Commissioner of Railroads requiring this company to reduce the rates of its passenger fare to 2½ cents per mile. The opinion upholds the order of the Commissioner.

LOUISVILLE & NASHVILLE.—In regard to the recent purchase of control by John W. Gates, and the subsequent conference between Mr. Gates and the firm of J. P. Morgan & Co., Geo. W. Perkins, of the latter company, gave out the following statement on April 15:

"At the request of Messrs. Harris, Gates & Co., who on their own independent account have recently made large purchases of Louisville & Nashville, Messrs. J. P. Morgan & Co., as bankers, have consented to take control of the stock so purchased and to receive the same on deposit. They have so consented solely to relieve the general financial condition, and not for the benefit of any railroad company. The Southern has no interest, direct or indirect, present or prospective, in this stock or in its purchase or deposit."

There was a concurrent activity, however, in the stocks of the Southern, which broke all records, and the total sales in the first hour of trading exceeded 350,000 shares. The stock opened at 34½ on April 15, and reached 40½ as the high level of the day, declining at the close to 37½, a net gain for the day of 3½ points on total sales of 882,500 shares. Transactions in Louisville & Nashville on April 15 aggregated 57,540 shares and closed at 127, a net loss for the day of one point.

It was announced April 7 that this company has taken over a majority of the stock of the Atlanta, Knoxville & Northern. This road extends from Marietta, Ga., to Knoxville, Tenn., 205 miles, with branches that bring the total mileage up to 228. The operations for the year ending June 30, 1900, showed a deficit of \$34,538 current, and \$26,786 forward, a total of \$61,324.

METROPOLITAN STREET (NEW YORK).—The temporary injunction obtained by Harry Content, Walter Content and Isidor Wormser, Jr., to prevent the lease of the Metropolitan Ry. Co.'s franchises and properties to the Interurban Co., was dissolved April 8 by Justice Gildersleeve in the New York Supreme Court.

MICHIGAN CENTRAL.—At a meeting of the directors April 4, it was voted to make a mortgage for \$18,000,000 with the Guaranty Trust Co. This will provide for an issue of 3½ per cent. 50-year gold bonds, \$10,000,000 of which will be applied to the payment of bonds falling due May 1, which bear interest variously at 7 per cent, and 5 per cent., and the remaining \$8,000,000 will be held for future extensions and betterments.

NATIONAL OF MEXICO.—At a meeting of the stockholders of this company in Salt Lake City April 9, a bond issue was authorized to provide for the purchase of the Mexican National and other properties. New securities were provided for as follows: Prior lien 4½ per cent. gold bonds not to exceed \$23,000,000; first consolidated mortgage bonds not to exceed \$60,000,000. The following additional directors were elected: Chas. T. Smith, Jose de Landa y Escandon, Robert P. Easton, E. M. Brown and Carl Smith, all of the City of Mexico. The stockholders also approved the proposition to build the El Salto extension; to purchase new equipment and standard gage the line as previously planned.

NEW YORK CENTRAL & HUDSON RIVER.—The Stock Exchange has authorized the listing of the \$17,250,000 additional capital stock recently offered, making a total of \$132,250,000 listed. The proceeds of this new stock are to be applied "for increasing terminal facilities at New York City, including enlargement of the Grand Central Station yard and additional tracks; for suburban traffic; for new elevator, docks and other extensive improvements at Weehawken, for construction and equipment expenditures on the main line and on lines leased and operated, and for such other corporate purposes as the directors may from time to time approve."

NORTHERN SECURITIES.—In answer to the motion made by the State of Washington to file a bill of complaint against the Northern Securities Co., former Attorney-General Griggs presented a brief on behalf of the Securities Co., in which he took the position that the bill of complaint did not present the case of a controversy of a civil nature, which under the Constitution and laws of the United States is justifiable in the Supreme Court; that it is rather a suit to enforce local law and policy of a State whose right to make laws and to enforce them exists only within itself, and that whatever the law of the State of Washington is upon the subject of the consolidation of railroad corporations, it is a municipal or police law and not one conferring rights of a proprietary or contractual nature. From this he draws the conclusion that neither the courts of the United States, nor of any other jurisdiction outside of the State of Washington, will lend their aid to the enforcement of the police laws of Washington.

ST. LOUIS SOUTHWESTERN.—In reference to the published notices dated Feb. 6, 1902, and March 13, 1902, asking for deposits of certificates, acceptance of the same to be optional with the company, announcement is now made, in view of the deposit of more than two-thirds of said certificates, that it is proposed, subject to the approval of the stockholders, to issue \$25,000,000 30-year 4 per cent. gold bonds to finance the purchase of certain branch lines and securities of other companies already acquired or in process of acquisition; to acquire and fund existing equipment obligations now outstanding, and to purchase further equipment; to make improvements and betterments on the property, etc. The new bonds will be secured by a mortgage on all the property owned by the company and covering as a first and only lien all bonds, stocks and other securities, and all the second mortgage gold income bond certificates and equipment obligations of the company acquired by the use of the new bonds or their proceeds, and all additions, extensions and branches so constructed or acquired. (March 28, p. 236.)

TRAVERSE CITY, LEELANAU & MANISTIQUE.—This company has made a mortgage to secure \$300,000 50-year 5 per cent. gold bonds on the proposed line from Traverse City to Northport, Mich., 25 miles, in connection with a car ferry across Lake Michigan to Manistique. At Manistique the Manistique & Northwestern R. R., recently acquired by the same interests, is joined.

UNDERGROUND RAILROADS IN LONDON.—See Technical.